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PRACTICE WITH SCIENCE.

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THESE EXPERIMENTS, IT IS TRUE, ARE NOT EASY; STILL THEY ARE IN THE POWER OF EVERY THINKING HUSBANDMAN. HE WHO ACCOMPLISHES BUT ONE, OF HOWEVER LIMITED APPLICATION, AND TAKES CARE TO REPORT IT FAITHFULLY, ADVANCES THE SCIENCE, AND, CONSEQUENTLY, THE PRACTICE OF AGRICULTURE, AND ACQUIRES THEREBY A RIGHT TO THE GRATITUDE OF HIS FELLOWS, AND OF THOSE WHO COME AFTER. TO MAKE MANY SUCH IS BEYOND THE POWER OF MOST INDIVIDUALS, AND CANNOT BE EXPECTED. THE FIRST CARE OF ALL SOCIETIES FORMED FOR THE IMPROVEMENT OF OUR SCIENCE SHOULD BE TO PREPARE THE FORMS OF SUCH EXPERIMENTS, AND TO DISTRIBUTE THE EXECUTION OF THESE AMONG THEIR MEMBERS.

VON THAER, *Principles of Agriculture.*

Spottiswoode & Co., Printers, New-street Square, London.

CONTENTS OF PART I., VOLUME XXIV.

SECOND SERIES.

APPENDIX.

DIRECTIONS TO THE BINDER.

The Binder is desired to collect together all the Appendix matter, with Roman numeral folios, and place it at the *end* of each volume of the Journal, excepting Titles and Contents, and Statistics &c., which are in all cases to be placed at the *beginning* of the Volume; the lettering at the back to include a statement of the *year* as well as the *volume*; the first volume belonging to 1839–40, the second to 1841, the third to 1842, the fourth to 1843, and so on.

In Reprints of the Journal all Appendix matter and, in one instance, an Article in the body of the Journal (which at the time had become obsolete), were omitted; the Roman numeral folios, however (for convenience of reference), were reprinted without alteration in the Appendix matter retained.

ERRATUM.

In the Report on the "Experiments on Ensilage" in the last issue of the 'Journal' (Vol. XXIII., Part II., 1887), in the table given at the bottom of page 409, *for* "46·95" *read* "41·95."

STATISTICS

AFFECTING BRITISH AGRICULTURAL INTERESTS.

CONTENTS.

METEOROLOGY IN 1887.[1]

First Quarter.—The weather in *January* till the 18th was very cold, snow fell frequently, and the ground in many parts of the country was covered with snow till after the 18th; from the 19th the weather was milder, with some days of fine weather. The temperature was very low on the 1st and 2nd; at Barnet on the 2nd it was as low as 8°. The mean temperature of these two days was nearly 14° below their average; low temperatures with severe frosts were experienced on every night till the 18th. At Rugby on the 17th the temperature of the air was as low as 6°·5, and the frost was severe at all stations. A change took place between the 18th and 19th, and to the end of the month the temperature was mostly above the average. The atmospheric pressure was below its average till the 10th, particularly from the 4th to the 9th; on both the 5th and 6th it was more than one inch below the average, and from the 11th to the end of the month it was constantly above the average. The fall of rain was small; fogs were frequent, particularly in the Midland Counties.

The weather in *February* was cold and dry, with frequent sharp frosts at night between the 6th and the 18th; at times the weather was pleasant. The temperature of the air was generally above the average till the 5th, and from the 19th to the 25th, and below on all other days. The pressure of the atmosphere was very remarkable. It was steadily high throughout the month; at the height of 160 feet above the mean level of the sea it was 30·145 inches, being higher than in any February back to 1841. The fall of rain was generally very small, and generally much below the average. Snow fell on a few days, and fog was rather prevalent.

The weather in *March* till the 21st day was very cold, with severe frosts every night; very severe winter weather was experienced from the 11th to the 21st. Snow fell generally over the country on nearly every one of these days. The temperature was continuously low to the 21st, particularly from the 13th; the mean temperature of the nine days ending the 21st was 10½° below their average; from the 21st the weather was milder. The mean temperature of the month was 4° below the average of 46 years. The atmospheric pressure was above the average till the 8th day, having been above the average since January 11; from March 9 to 16 it was low, and after this it was for a few days together above, and then for a few days below the average to the end of the month.

The *rainfall* recorded at 34 stations of observation ranged from 2·91 inches at Blackheath, 3·03 inches at Greenwich, and 3·11 inches at Holkham, to 6·48 inches at Salisbury, 7·60 inches at Bath, and 8·12 inches at Stonyhurst. Rain was measured at Greenwich on 14 days in January, 4 in February, and 10 in March, or on 28 of the 90 days in the quarter.

[1] Abstracted from the particulars supplied to the Registrar-General by James Glaisher, Esq., F.R.S., &c.

Second Quarter.—The weather in *April* was very cold and dry. The temperature of the air was below its average on every day excepting from the 19th to the 23rd, and particularly so from the 14th to the 17th. The atmospheric pressure was below its average till the 7th, and from the 21st. The fall of rain was small. The N.E. wind was prevalent. It was an ungenial month, and vegetation was very backward.

The weather in *May* was generally cold, sunless, and unseasonable, with an unusual prevalence of winds from the N., N.E., and N.W. The temperature, with the exception of the five days between the 8th and 12th, was constantly below the average, and particularly so on the 21st and 22nd, on which day snow fell at some places and rain and hail at others, with a cold high wind. It was the sixth month in succession with the mean temperature below the average. We have to go back for forty-two years for so low a temperature for the three months ending May—a period so important for vegetation—and practically there was only one instance of a decided lower temperature in this century, viz., in the year 1837. The atmospheric pressure in May was above its average from the 7th to the 17th, and from the 23rd to the 27th, and was mostly below on the other days. The fall of rain was less than the average at most stations. Snow fell on several days in the Midland and Northern counties.

The weather in *June* was very fine and dry. The temperature till the 5th day was rather low, on the 6th there was a sudden change to warmth, and from this day to the 20th the weather was very fine and hot; from the 21st to the end of the month it was fine, but rather cool. The atmospheric pressure was below the average till the 4th, and constantly above from the 5th. There was a preponderance of N.E. wind, and almost an absolute freedom from thunderstorms. The fall of rain was deficient at all stations, and a severe drought was experienced at many places. There were heavy falls of rain generally on the 3rd and 4th, and scarcely any afterwards till the end of the month. The drought was not felt till the middle of this month, but the weather had been dry since January. Up to the end of June the average fall of rain from the seventy-two years' previous observations is 10·8 inches, and the fall this year is 3·1 inches short of the average.

The *rainfall* recorded at 33 stations of observation ranged from 3·01 inches at Torquay, 3·14 inches at Osborne, and 3·15 inches at Wolverhampton and Halifax, to 4·70 inches at Greenwich, 5·16 inches at Stonyhurst, and 5·78 inches at Bath. Rain was measured at Greenwich on 11 days in April, 18 in May, and 3 in June, or on 32 of the 91 days in the quarter.

Third Quarter.—The weather in *July* was very fine and warm. The temperature of the air was above its average on every day excepting the 17th, 18th, and 19th, and particularly so on the 2nd, 3rd, 4th, and 8th days. The atmospheric pressure was above its average excepting only a few days. The fall of rain was much below its average at all stations. The drought mentioned last month, which generally began on June 5, was broken on July 4, thus showing an absolute drought of 30 days' duration. The fall of rain both preceding and following those days was generally very small, so that the drought was of much longer duration, consequently water supplies

were very low, and pastures were burnt up. The hay crop was gathered without rain, and harvest work began early.

The weather in *August* was very fine and dry, with a more than average amount of sunshine. The temperature of the air was a little below the average at the beginning of the month, and from the 10th to the 20th, and above on other days. The atmospheric pressure was above its average till the 15th, and below from the 16th. The fall of rain was less than its average at most places. On the 16th and 17th there were thunderstorms over the country, and that on the 17th was most severe over London. The fall of rain varied from one inch to two inches in London and places a little south of London. At Blackheath 0·84 inch fell on the evening of the 17th within 20 minutes, and 1·75 fell in the day. This heavy fall was not experienced at Barnet, where 0·54 inch fell. The fall at Wolverhampton was 0·85, and at Carlisle was 1·14 inch, the largest fall at any other station was 0·47 inch at Southbourne. These refreshing showers were far from being general, and pastures at many places were dried up and streams very low.

The weather in *September* was cold and unsettled; the temperature of the air was below its average on nearly every day, particularly so at the end of the month. The atmospheric pressure was below its average during the first half of the month, and again from the 26th. The fall of rain was above its average at some places and below it at others. The first part of the month the S.W. wind was prevalent, and again from the 25th to the 28th; at other times the N.E. was the most prevalent.

The *rainfall* recorded at 34 stations of observation ranged from 3·22 inches at Rugby, 3·66 inches at Cardington, and 3·71 inches at Cambridge, to 8·19 inches at Bath, 10·33 inches at Stonyhurst, and 10·62 inches at Carlisle. Rain was measured at Greenwich on 13 days in July, 10 in August, and 10 in September, or on 33 of the 92 days in the quarter.

Fourth Quarter.—The weather in *October* was generally fine, but very cold. The temperature of the air was below its average on nearly every day, particularly so from the 11th to the 18th, and from the 22nd to the 26th. The month was colder than any October back to the year 1817, when it was of the same temperature. The minimum temperature of the month at Greenwich, 25°·3, was lower than any previous reading at Greenwich; at many of the stations the temperature was still lower. These low readings in October are of very rare occurrence. The atmospheric pressure was above its average till the 8th, and from the 15th to the 27th, and was below on the remaining 10 days. The fall of rain was less than the average at all the stations, the soil was in consequence very dry, and streams were generally low, the wind was chiefly from the N.W., and a gale was blowing at the end of the month.

The month of *November* was dry and cold. The temperature of the air did not differ much from the average till the 15th day; very cold weather then set in and continued to the 22nd. The atmospheric pressure was below the average till the 10th, and from the 18th. The fall of rain was above the average at some stations and below at others. The wind was chiefly

from the N.E., and was strong at both the beginning and towards the end of the month. Dense fogs prevailed on the 20th and 21st.

The month of *December* was fine and rather cold. The temperature of the air was a little above the average till the 4th, and was below from the 5th. The atmospheric pressure was above the average till the 5th, and from the 29th. The rain was generally less than the average. The wind was mostly from the N.W. It was a fine winter month.

About London the mean daily temperature of the air was below its average on nearly every day throughout October and till the 25th day of November. The mean daily deficiency for these 56 days was 5°·4; from November 26 to December 4 it was above the average, the mean daily excess was 1°·4; from December 5 to the 31st was generally below the average, mean daily deficiency was 3°·8.

The *rainfall* recorded at 33 stations of observation ranged from 4·09 inches at Nottingham, 4·21 inches at Cambridge, and 4·60 inches at Cardington, to 12·84 inches at Plymouth, 12·89 inches at Truro, and 14·12 inches at Guernsey. Rain was measured at Greenwich on 11 days in October, 20 in November, and 16 in December, or on 47 of the 92 days in the quarter.

Wind Observations.—The average duration of the different directions of the wind at eight points of the compass in each month of 1887, at the Royal Observatory, Greenwich, was as follows:—

Months	Direction of Wind							
	N.W.	N.	N.E.	E.	S.E.	S.	S.W.	W.
	days	days	days	days	days	days	days	days
January .	2·00	3·50	3·25	1·00	3·25	4·50	9·75	3·75
February .	2·50	3·00	4·00	2·00	1·50	3·00	9·00	3·00
March .	3·00	4·00	4·00	3·00	2·50	3·00	8·00	3·50
April . .	2·25	4·25	6·25	3·50	2·25	2·50	6·25	2·75
May . .	1·50	4·75	7·50	2·25	1·75	2·75	8·25	2·25
June . .	2·50	3·50	3·75	2·25	1·75	2·25	10·00	4·00
July . .	3·00	4·00	3·50	2·00	1·50	3·00	10·00	4·00
August .	3·00	3·00	3·00	1·50	1·50	3·00	12·00	4·00
September	4·00	6·00	2·00	2·00	3·00	8·00	3·00	2·00
October .	2·50	3·50	3·00	1·50	2·00	4·00	10·00	4·50
November	2·50	4·25	4·00	2·25	2·25	4·00	8·50	2·25
December	2·50	3·00	2·50	2·00	2·00	3·50	11·00	4·25
Totals for 1887	31·25	46·75	46·75	25·25	25·25	43·50	105·75	40·25

The following Table (I.) gives the Meteorological Observations recorded at the Royal Observatory, Greenwich, for each month of the year 1887:—

TABLE I.—Meteorological Observations recorded at

1887. Months	Temperature of Air: Mean	Air: Diff. from average of 116 years	Air: Diff. from average of 46 years	Evaporation: Mean	Evaporation: Diff. from average of 46 years	Dew Point: Mean	Dew Point: Diff. from average of 46 years	Air—Daily Range: Mean	Air—Daily Range: Diff. from average of 46 years	Elastic Force of Vapour: Mean	Elastic Force of Vapour: Diff. from average of 46 years	Weight of Vapour in a Cubic Foot of Air: Mean	Weight of Vapour: Diff. from average of 46 years
	°	°	°	°	°	°	°	°	°	in.	in.	grs.	grs.
Jan. .	35·6	−1·0	−2·8	34·8	−2·1	32·9	−2·0	9·6	+0·1	·187	−·014	2·2	−0·2
Feb. .	38·8	0·0	−0·8	36·7	−1·3	33·8	−1·6	12·9	+1·8	·194	−·015	2·3	−0·1
March .	37·6	−3·5	−4·1	35·3	−4·0	32·1	−3·9	14·1	−0·6	·182	−·033	2·1	−0·4
Means	37·3	−1·5	−2·6	35·6	−2·5	32·9	−2·5	12·2	+0·4	·188	−·021	2·2	−0·2
April .	44·1	−2·0	−3·0	40·5	−3·4	36·3	−4·2	19·8	+1·4	·214	−·039	2·5	−0·4
May .	49·8	−2·7	−2·7	46·6	−2·2	43·5	−1·5	16·7	−3·8	·283	−·015	3·2	−0·2
June .	60·9	+2·6	+2·1	55·8	+1·3	51·3	+0·7	23·7	+2·7	·380	+·010	4·2	0·0
Means	51·6	−0·7	−1·2	47·6	−1·4	43·7	−1·7	20·1	+0·1	·292	−·015	3·3	−0·2
July .	66·5	+4·8	+4·3	59·4	+1·7	53·7	−0·2	26·4	+5·4	·413	−·005	4·6	−0·2
August .	62·5	+1·6	+1·1	56·2	−1·2	50·8	−3·1	23·8	+4·0	·371	−·048	4·1	−0·7
Sept. .	54·0	−2·6	−3·1	50·9	−3·1	47·9	−3·3	16·0	−2·2	·334	−·046	3·8	−0·6
Means	61·0	+1·3	+0·8	55·5	−0·9	50·8	−2·2	22·1	+2·4	·373	−·033	4·2	−0·5
October	45·0	−4·6	−5·0	42·6	−2·9	39·7	−6·2	14·3	−0·2	·244	−·066	2·8	−1·2
Nov. .	40·8	−1·6	−2·7	39·5	−0·6	37·8	−1·6	9·4	−2·1	·227	−·018	2·7	−0·2
Dec. .	38·1	−1·0	−1·8	36·3	−0·3	33·9	−2·6	8·7	−0·7	·185	−·023	2·3	−0·4
Means	41·3	−2·4	−3·2	39·5	−1·3	37·1	−3·5	10·8	−1·0	·222	−·036	2·6	−0·6

Note.—In reading this table it will be borne in mind that the *plus* sign (+)

THE ROYAL OBSERVATORY, GREENWICH, FOR THE YEAR 1887.

Degree of Humidity		Reading of Barometer		Weight of a Cubic Foot of Air		Rain		Daily horizontal movement of the air	Reading of Thermometer on Grass					1887.
									Number of nights it was					
Mean Saturation = 100	Diff. from average of 46 years	Mean	Diff. from average of 46 years	Mean	Diff. from average of 46 years	Amount	Diff. from average of 72 years		At or below 30°	Between 30° and 40°	Above 40°	Lowest reading at night	Highest reading at night	Months
		in.	in.	grs.	grs.	in.	in.	Miles				°	°	
92	+ 2	29·831	+ ·084	558	+ 4	1·15	– 0·76	238	22	9	0	14·9	38·0	Jan.
84	– 1	30·145	+ ·356	561	+ 8	0·53	– 1·05	315	18	9	1	13·7	42·0	Feb.
83	0	29·891	+ ·138	557	+ 7	1·35	– 0·16	288	19	12	0	14·6	35·0	Mar.
						Sum	Sum	Mean	Sum	Sum	Sum	Lowest	Highest	
86	0	29·956	+ ·193	559	+ 6	3·03	– 1·97	280	59	30	1	13·7	42·0	*Means*
75	– 5	29·818	+ ·072	548	+ 5	1·75	– 0·01	343	15	15	0	19·1	38·5	April
80	+ 1	29·834	+ ·047	542	+ 2	1·72	– 0·36	289	4	18	9	23·3	47·0	May
72	– 3	30·013	+ ·207	533	+ 1	1·23	– 0·74	244	0	7	23	33·2	51·7	June
						Sum	Sum	Mean	Sum	Sum	Sum	Lowest	Highest	
76	– 4	29·888	+ ·108	541	+ 3	4·70	– 1·11	292	19	40	32	19·1	51·7	*Means*
64	– 11	29·866	+ ·069	525	– 3	1·29	– 1·22	248	0	3	28	37·3	58·5	July
66	– 10	29·807	+ ·023	528	– 1	2·34	– 0·01	210	0	8	23	33·4	55·9	Aug.
80	– 1	29·759	– ·039	536	+ 3	2·22	– 0·21	283	3	15	12	27·0	51·7	Sept.
						Sum	Sum	Mean	Sum	Sum	Sum	Lowest	Highest	
70	– 7	29·811	+ ·018	530	0	5·85	– 1·44	247	3	26	63	27·0	58·5	*Means*
82	– 7	29·916	+ ·208	549	+ 9	1·03	– 1·76	255	19	5	7	18·0	47·9	Oct.
89	– 1	29·530	– ·212	547	– 1	3·78	+ 1·44	281	11	16	3	15·5	42·2	Nov.
85	– 5	29·676	– ·113	543	– 9	1·47	– 0·52	308	20	10	1	16·7	40·8	Dec.
						Sum	Sum	Mean	Sum	Sum	Sum	Lowest	Highest	
85	– 4	29·707	– ·039	546	0	6·28	– 0·84	281	50	31	11	15·5	47·9	*Means*

signifies *above* the average, and that the *minus* sign (–) signifies *below* the average.

TABLE II.—HAY HARVEST FORECASTS, 1887.

RETURN SHOWING THE NUMBER OF FORECASTS SENT TO EACH OF THE UNDERMENTIONED DISTRICTS, WITH THE RESULTS OF THE FORECASTS.

Districts	Names of Stations	Forecasts		Percentages				Total percentage of Success
		Number sent	Number returned	Complete Success	Partial Success	Partial Failure	Total Failure	
Scotland, N.	Golspie and Munlochy	60	60	54	38	8	—	92
Scotland, E.	North Berwick, Aberfeldy, Braco Grange, and Glamis	120	102	49	26	2	23	75
England, N.E.	Ulceby and Chatton, Northumberland	60	60	45	39	13	3	84
England, E.	Rothamsted and Thorpe	60	48	71	22	3	4	93
Midland Counties	Cirencester and East Retford	60	60	50	30	12	8	80
England, S.	Horsham, Maidstone, and Downton	90	88	66	31	3	—	97
Scotland, W.	Dumbarton, Stranraer, and Islay	96	90	61	33	6	—	94
England, N.W.	Leyburn, Liverpool, and Prescot	73	71	56	35	6	3	91
England, S.W.	Bridgend (Glamorgan), Clifton, and Spring Bank (Gloucestershire)	66	65	55	37	8	—	92
Ireland, N.	Hollymount and Moynalty	60	48	52	34	14	—	86
Ireland, S.	Ardfert, Moneygall, and Kilkenny	90	90	58	33	9	—	91
	Mean for all Districts . . .			56	32	8	4	88

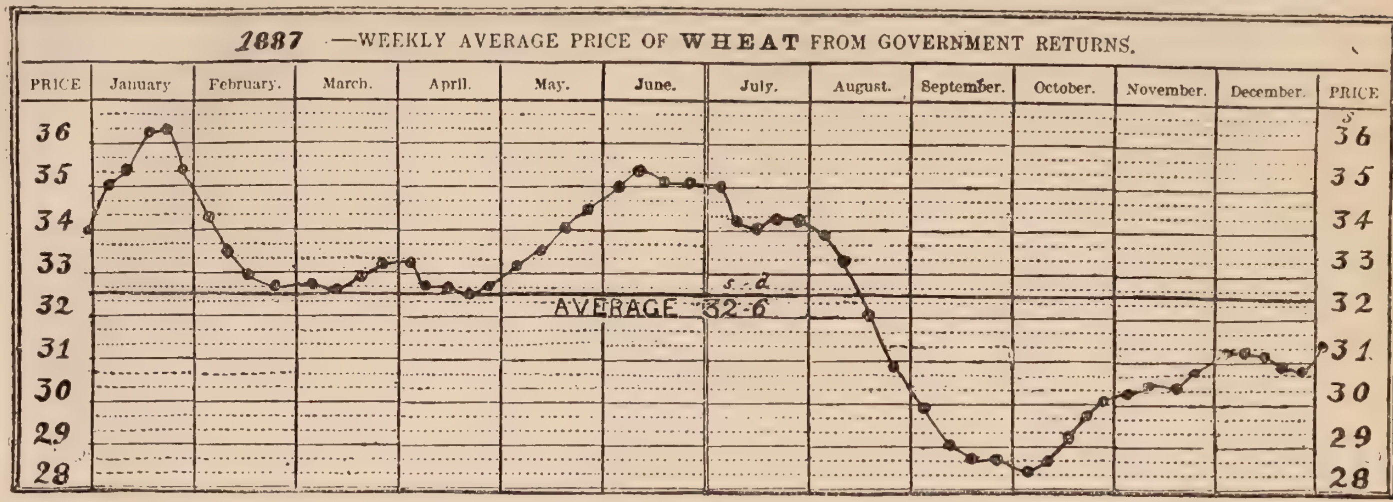
NOTE.—Mr. Frederick Gaster, in forwarding the detailed results of the checking of the "Hay Harvest Forecasts for 1887" to the Secretary of the Meteorological Council, remarks *inter alia* :—

"The general percentage of successful forecasts (88) is much larger than that of last year, and larger than that for any of the preceding years since the system was commenced—a result which may be due partly to the quiet character of the weather prevailing at the time, but partly also to the extended area of observation which was inaugurated at the beginning of the year, and which has been of so much value to us in the work of forecasting and warning for storms."

Some of the recipients have voluntarily borne testimony to the success of the forecasts. Sir J. Shelley, Shobrooke Park, Crediton, says: . . . . "I can only say that as far as this season is concerned the telegrams were almost entirely correct." Mr. H. V. Boothby, Butterby Farm, Alfreton, says: "They have been very useful." Mr. J. Fergusson, Brettenham Manor, Thetford, says: "I must say the forecasts were most accurate." Major Smith, of Munlochy, Inverness, remarked each week that the forecasts were "very satisfactory." Mr. J. Turner, of The Grange, Ulceby, says: "I think the prognostications have been very true."

TABLE III.—THE PRICE OF WHEAT FOR 1887.

The Annual Imperial average price of Wheat advanced in 1887 1*s.* 6*d.* a quarter above that of 1886, which was 31*s.*; in 1887 it reached 32*s.* 6*d.* a quarter. The highest weekly average was on January 22, 1887, 36*s.* 4*d.*, and the lowest on October 1, 28*s.* 5*d.* The year commenced at 35*s.*, and terminated at 30*s.* 9*d.* The Annual Imperial average of Corn was—Wheat, 32*s.* 6*d.*; Barley, 25*s.* 4*d.*; and Oats, 16*s.* 3*d.* a quarter. The Septennial Tithe Rent Charge was still lower than in 1886; it then stood at 87*l.* 8*s.* 10*d.*; but for 1887 it was 84*l.* 2*s.* $8\frac{3}{4}$*d.*, or 3*l.* 6*s.* $1\frac{1}{4}$*d.* lower than 1886, or 5*l.* 13*s.* 0*d.* per 100*l.* lower than it has been since the Commutation in 1836. The lowest point previously was 89*l.* 15*s.* $8\frac{3}{4}$*d.* in 1885.



The space between each horizontal line indicates four pence.

Jan.	s.	d.	Feb.	s.	d.	March	s.	d.	April	s.	d.
1,	35	0	5,	34	3	5,	32	9	2,	33	3
8,	35	4	12,	33	6	12,	32	7	9,	32	8
15,	36	3	19,	32	11	19,	32	11	16,	32	8
22,	36	4	26,	32	7	26,	32	2	23,	32	6
29,	35	5							30,	32	8

May	s.	d.	June	s.	d.	July	s.	d.	Aug.	s.	d.
7,	33	2	4,	35	0	2,	35	0	6,	33	11
14,	33	6	11,	35	4	9,	34	2	13,	33	3
21,	34	1	18,	35	1	16,	34	0	20,	32	0
28,	34	6	25,	35	1	23,	34	3	27,	30	10
						30,	34	3			

Sept.	s.	d.	Oct.	s.	d.	Nov.	s.	d.	Dec.	s.	d.
3,	29	11	1,	28	5	5,	30	3	3,	31	3
10,	29	1	8,	28	7	12,	30	6	10,	31	2
17,	28	8	15,	29	3	19,	30	5	17,	31	2
24,	28	9	22,	29	9	26,	30	9	24,	30	10
			29,	30	1				31,	30	9

Averages for 1887	s.	d.
Wheat . .	32	6
Barley . .	25	4
Oats . . .	16	3

TABLE IV.—Estimated Total Produce and Yield per Acre of each Grass, and Number of Horses, Cattle, Sheep, and Pigs, in

[*From Returns of Agricultural*

Description of Crops	Great Britain								
	Acreage, 'thousands' (000) omitted			Produce of crops, 'thousands' (000) omitted			Yield per acre		
	1885	1886	1887	1885	1886	1887	1885	1886	1887
Corn Crops :—	Acres	Acres	Acres	Bush.	Bush.	Bush.	Bush.	Bush.	Bush.
Wheat	2,478	2,286	2,317	77,588	61,468	74,323	31·3	26·9	32·0
Barley or Bere	2,257	2,241	2,085	79,251	72,090	65,301	35·1	32·2	31·3
Oats	2,941	3,082	3,088	108,365	116,596	107,283	36·8	37·8	34·7
Rye	51	56	55	—	—	—	—	—	—
Beans	435	381	371	8,907	10,307	8,339	20·5	27·0	22·5
Peas	230	214	230	4,321	5,855	5,608	18·8	27·3	24·4
Total Corn Crops	8,392	8,260	8,146	—	—	—	—	—	—
Green Crops :—				Tons	Tons	Tons	Tons	Tons	Tons
Potatoes	549	554	560	3,198	3,168	3,565	5·8	5·7	6·4
Turnips and Swedes	2,015	2,003	1,972	20,511	29,983	19,748	10·2	15·0	10·0
Mangold	355	349	361	5,470	7,280	5,423	15·4	20·8	15·0
Carrots and Parsnips	16	16	16	—	—	—	—	—	—
Cabbage, Kohl-rabi, and Rape	153	152	154	—	—	—	—	—	—
Vetches, Lucerne, and any other crop (except clover or grass)	434	406	401	—	—	—	—	—	—
Total Green Crops	3,522	3,480	3,464	—	—	—	—	—	—
Other Crops, Grass, &c. :—									
Clover and artificial and other grasses under rotation, including permanent pasture, or grass not broken up in rotation (exclusive of heath or mountain land)	13,814	13,558	13,565	—	—	—	—	—	—
Ditto under meadow for hay	6,182	6,666	6,887	8,731	9,075	7,894	—	—	—
				Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
Flax	2	3	4	—	—	—	—	—	—
Hops	71	70	64	509	776	458	7·1	11·1	7·2
Total other Crops	20,069	20,297	20,520	—	—	—	—	—	—

Description of Live Stock :—	Year 1885	Year 1886	Year 1887
	Actual No.	Actual No.	Actual No.
Horses	1,408,789	1,425,359	1,428,383
Cattle	6,597,964	6,646,683	6,441,268
Sheep	26,534,635	25,520,718	25,958,768
Pigs	2,403,380	2,221,475	2,299,323

Note.—The produce of the Corn Crops for Ireland, which was originally given in weight, has been converted and 60 *lbs.* to the bushel of Beans and Peas,

OF THE PRINCIPAL CROPS, AND ALSO THE ACREAGE UNDER OTHER CROPS AND GREAT BRITAIN AND IRELAND, IN EACH OF THE YEARS 1885–87.

Department of Privy Council.]

Ireland									United Kingdom								
Acreage, 'thousands' (000) omitted			Produce of crops, 'thousands' (000) omitted			Yield per acre			Acreage, 'thousands' (000) omitted			Produce of crops, 'thousands' (000) omitted			Yield per acre		
1885	1886	1887	1885	1886	1887	1885	1886	1887	1885	1886	1887	1885	1886	1887	1885	1886	1887
Acres	Acres	Acres	Bush.	Bush.	Bush	Bush.	Bush.	Bush.	Acres	Acres	Acres	Bush.	Bush.	Bush.	Bus.	Bus.	Bus.
71	70	67	2,048	1,880	1,902	28·8	27·0	28·3	2,549	2,355	2,385	79,636	63,348	76,225	31·2	26·9	32·0
180	182	162	6,470	6,219	4,647	36·1	34·2	28·6	2,436	2,423	2,248	85,722	78,310	69,948	35·2	32·3	31·1
1,328	1,322	1,315	52,076	52,780	43,506	39·2	40·0	33·1	4,270	4,401	4,403	160,441	169,376	150,789	37·6	38·5	34·3
8	11	11	—	—	—	—	—	—	59	67	66	—	—	—	—	—	—
6	6	6	215	183	134	33·5	30·5	21·1	441	387	377	9,122	10,490	8,473	20·7	27·1	22·5
1	1	1	18	18	16	25·0	26·2	23·1	231	215	230	4,339	5,875	5,623	18·8	27·3	24·4
1,594	1,592	1,562	—	—	—	—	—	—	9,986	9,851	9,709	—	—	—	—	—	—
			Tons	Tons	Tons	Tons	Tons	Tons				Tons	Tons	Tons	Tons	Tons	Tons
797	800	797	3.176	2,668	3,569	4·0	3·3	4·5	1,346	1,354	1,357	6,374	5,835	7,134	4·7	4·3	5·3
[1] 297	[1] 299	[1] 300	3,552	[1] 3.975	[1] 2,719	[1] 12·0	[1] 13·3	[1] 9·1	2,312	2,302	2,272	24,063	33,957	22,467	10·4	14·7	9·9
[2] 37	[2] 37	[2] 42	[2] 500	[2] 506	[2] 455	[2] 13·4	[2] 13·5	[2] 10·9	392	387	402	5.969	7,786	5,878	15·2	20·1	14·6
3	3	3	—	—	—	—	—	—	20	20	19	—	—	—	—	—	—
48	46	50	—	—	—	—	—	—	201	198	204	—	—	—	—	—	—
37	36	37	—	—	—	—	—	—	470	442	438	—	—	—	—	—	—
1,219	1,221	1,229	—	—	—	—	—	—	4,741	4,703	4,692	—	—	—	—	—	—
10,244	10,160	10,052	—	—	—	—	—	—	24,058	23,718	23,617	—	—	—	—	—	—
2,035	2,094	2,144	4,156	4,429	3,599	—	—	—	8,217	8,760	9,031	12,887	13,503	11,493	—	—	—
			Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.				Cwts.	Cwts.	Cwts.	Cwt.	Cwt.	Cwt.
108	128	130	313	412	303	3·5	3·8	2·3	110	131	134	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	71	70	64	509	776	458	7·1	11·1	7·2
12,387	12,382	12,326	—	—	—	—	—	—	32,456	32,679	32,846	—	—	—	—	—	—

Year 1885	Year 1886	Year 1887	Year 1885	Year 1886	Year 1887
Actual No. 491,147	Actual No. 492,831	Actual No. 499,330	Actual No. 1,899,936	Actual No. 1,918,190	Actual No. 1,927,713
4,228,751	4,184,027	4,157,409	10,826,715	10,830,710	10,598,677
3,477,840	3,367,722	3,378,417	30,012,475	28,888,440	29,337,185
1,269,122	1,263,133	1,408,485	3,672,502	3,484,608	3,707,808

into *bushels*, at the rate of 60 *lbs.* to the bushel of Wheat ; 50 *lbs.* to the bushel of Barley ; 39 *lbs.* to the bushel of Oats ;

[1] Turnips only. [2] Including Beetroot.

TABLE V.—AVERAGE PRICES OF BRITISH CORN PER QUARTER (Imperial measure) as received from the Inspectors and Officers of Excise according to the Act of 27 & 28 Vict. ch. 87, in each week of the year 1887; and also in each of the twenty years 1868–87.

[*From the "London Gazette."*]

Week ending	Wheat		Barley		Oats		Week ending	Wheat		Barley		Oats	
1887	s.	d.	s.	d.	s.	d.	1887	s.	d.	s.	d.	s.	d.
January 1 .	35	0	25	11	17	0	July 2 . .	35	0	20	10	17	6
January 8 .	35	4	26	4	16	11	July 9 . .	34	2	20	11	17	0
January 15 .	36	3	26	8	17	4	July 16 . .	34	0	20	5	16	9
January 22 .	36	4	27	1	17	2	July 23 . .	34	3	21	4	17	9
January 29 .	35	5	26	7	17	1	July 30 . .	34	3	21	8	17	1
February 5 .	34	3	26	7	17	1	August 6 .	33	11	20	10	17	1
February 12 .	33	6	25	7	16	10	August 13 .	33	3	20	7	16	10
February 19 .	32	11	26	2	17	0	August 20 .	32	0	23	11	16	4
February 26 .	32	7	25	0	16	11	August 27 .	30	10	24	5	16	3
March 5 .	32	9	25	1	16	2	September 3 .	29	11	27	3	15	6
March 12 .	32	7	24	3	16	4	September 10	29	1	26	10	14	10
March 19 .	32	11	24	4	16	4	September 17	28	8	27	4	14	7
March 26 .	33	2	23	2	16	4	September 24	28	9	28	0	14	11
Average of Winter Quarter	34	0	25	7	16	9	Average of Summer Quarter	32	1	23	4	16	4
April 2 . .	33	3	24	4	16	1	October 1 .	28	5	28	10	14	10
April 9 . .	32	8	23	11	15	8	October 8 .	28	7	28	6	15	1
April 16 . .	32	8	24	2	15	10	October 15 .	29	3	29	0	15	3
April 23 . .	32	6	23	2	16	3	October 22 .	29	9	28	10	15	4
April 30 . .	32	8	24	2	16	2	October 29 .	30	1	29	7	15	5
May 7 . .	33	2	23	2	16	0	November 5 .	30	3	29	7	15	11
May 14 . .	33	6	22	0	16	7	November 12 .	30	6	29	6	15	5
May 21 . .	34	1	21	9	16	3	November 19 .	30	5	29	6	15	6
May 28 . .	34	6	23	1	16	9	November 26 .	30	9	29	6	15	11
June 4 . .	35	0	23	9	16	7	December 3 .	31	3	29	3	16	1
June 11 . .	35	4	22	1	17	0	December 10 .	31	2	29	0	15	11
June 18 . .	35	1	21	10	17	4	December 17 .	31	2	29	1	16	2
June 25 . .	35	1	20	7	16	9	December 24 .	30	10	28	11	15	10
							December 31 .	30	9	29	3	16	1
Average of Spring Quarter	33	9	22	11	16	4	Average of Autumn Quarter	30	2	29	2	15	7

ANNUAL AVERAGES FOR YEARS 1868 TO 1887.

Year	Wheat		Barley		Oats		Year	Wheat		Barley		Oats	
	s.	d.	s.	d.	s.	d.		s.	d.	s.	d.	s.	d.
1868	63	9	43	0	28	1	1878	46	5	40	2	24	4
1869	48	2	39	5	26	0	1879	43	10	34	0	21	9
1870	46	11	34	7	22	10	1880	44	4	33	1	23	1
1871	56	8	36	2	25	2	1881	45	4	31	11	21	9
1872	57	0	37	4	23	2	1882	45	1	31	2	21	10
1873	58	8	40	5	25	5	1883	41	7	31	10	21	5
1874	55	9	44	11	28	10	1884	35	9	30	8	20	3
1875	45	2	38	5	28	8	1885	32	10	30	2	20	7
1876	46	2	35	2	26	3	1886	31	1	26	7	19	0
1877	56	9	39	8	25	11	1887	32	6	25	4	16	3

TABLE VI.—QUANTITIES OF BRITISH CORN sold in the Towns from which Returns are received under Acts 27 & 28 Vict. ch. 87, and 45 & 46 Vict. ch. 37, in each of the years 1878 to 1887.

[*From the "London Gazette."*]

Years	Wheat	Barley	Oats
	Qrs.	Qrs.	Qrs.
1878	2,141,759	1,732,075	184,041
1879	2,022,125	1,421,244	161,693
1880	1,607,908	1,591,925	164,791
1881	1,738,255	1,631,504	211,444
1882	1,903,858	1,873,820	211,799
1883	2,901,146	2,575,528	408,471
1884	2,833,132	3,149,341	492,918
1885	2,739,515	2,765,500	393,042
1886	2,739,822	2,474,466	367,083
1887	2,495,124	2,589,667	309,478

TABLE VII.—Returns published pursuant to the Corn Returns Act, 1882, and to Act of 6 & 7 Wm. IV. for *Commutation of Tithes in England and Wales*, showing what has been, during the Seven Years ending Christmas Day in each Year, the AVERAGE PRICE of an IMPERIAL BUSHEL of British Wheat, Barley, and Oats, computed from the Weekly Averages of Corn Returns in each of the years 1881–87.

[*From the "London Gazette."*]

Years	Average (Septennial) prices per bushel		
	Wheat	Barley	Oats
	s. *d.*	*s.* *d.*	*s.* *d.*
1881	5 $10\frac{1}{4}$	4 6	3 $0\frac{3}{4}$
1882	5 $10\frac{1}{4}$	4 $4\frac{1}{2}$	2 $11\frac{1}{4}$
1883	5 2	3 11	2 8
1884	5 $4\frac{3}{4}$	4 $1\frac{3}{4}$	2 9
1885	5 $1\frac{3}{4}$	3 $11\frac{3}{4}$	2 $8\frac{1}{4}$
1886	4 11	3 10	2 $7\frac{1}{2}$
1887	4 $8\frac{1}{2}$	3 $8\frac{1}{2}$	2 $6\frac{1}{4}$

TABLE VIII.—COMPUTED REAL VALUE OF CORN IMPORTED INTO THE UNITED KINGDOM IN EACH OF THE SEVEN YEARS 1881–87.

[*From Trade and Navigation Returns.*]

	1881	1882	1883	1884	1885	1886	1887
	£	£	£	£	£	£	£
Wheat . . .	31,466,804	34,237,099	31,434,888	19,825,021	24,066,013	17,888,155	21,335,902
Barley . . .	4,069,402	5,541,498	5,784,504	4,228,722	4,528,823	3,968,437	3,769,272
Oats . . .	3,781,013	4,603,983	5,043,011	4,195,514	4,252,135	3,974,434	3,489,818
Maize . . .	10,392,460	6,522,070	10,314,307	7,303,099	8,473,863	7,614,113	7,535,946
Beans and Peas .	1,617,820	1,637,282	2,114,289	1,820,366	1,758,105	1,512,985	1,662,992
Wheat Flour .	9,205,807	10,631,933	12,318,144	10,166,010	9,651,508	8,254,407	10,020,433
Other kinds of Flour	24,007	21,966	31,038	23,970	18,811	12,899	4,934
Total of Corn	60,557,313	63,195,831	67,040,181	47,562,702	52,749,258	43,225,430	47,819,297

TABLE IX.—QUANTITIES OF WHEAT, BARLEY, OATS, PEAS, BEANS, INDIAN CORN, OR MAIZE, WHEATMEAL, AND FLOUR, IMPORTED IN THE FIVE YEARS 1883–87; ALSO THE COUNTRIES FROM WHICH THE WHEAT, WHEATMEAL, AND FLOUR WERE OBTAINED.

[*From Trade and Navigation Returns.*]

(Thousands ("000") omitted.)

	1883	1884	1885	1886	1887
Wheat from—	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
Russia	13,293	5,402	11,986	3,710	5,523
Germany	2,871	1,090	1,983	1,318	1,552
France	9	19	3	3	71
Turkey and Roumania	1,532	505	1,063	539	587
Egypt	1,174	1,000	110	41	198
United States	26,066	22,606	24,279	24,621	30,505
Chili	2,310	1,056	1,623	1,702	2,206
British India	11,244	8,010	12,102	11,029	8,509
Australasia	2,692	4,898	5,279	739	1,347
British North America	1,798	1,757	1,746	3,081	3,965
Other countries	1,091	771	1,280	622	1,322
Total Wheat	64,080	47,114	61,454	47,465	55,785
Wheatmeal and Flour from—					
Germany	1,929	1,747	1,415	817	589
France	164	154	187	115	98
United States	11,271	10,341	11,728	11,473	14,873
British North America	469	689	281	770	959
Other countries	2,461	2,173	2,224	1,564	1,538
Total Wheatmeal and Flour	16,294	15,104	15,835	14,739	18,057
Barley	16,594	12,987	15,392	13,723	14,277
Oats	15,248	12,936	13,062	13,495	14,469
Peas	1,880	1,935	2,004	2,047	2,990
Beans	3,578	3,520	3,515	2,804	2,477
Indian Corn or Maize	31,539	24,795	31,468	30,998	31,123
Indian Corn Meal	36	16	14	10	6

TABLE X.—FOOD IMPORTS.—VALUE PER HEAD OF POPULATION OF THE UNITED KINGDOM, OF THE SEVERAL KINDS OF AGRICULTURAL FOOD PRODUCTS IMPORTED FROM FOREIGN COUNTRIES AND BRITISH POSSESSIONS IN THE YEARS 1877–1886.

[*From Agricultural Returns of Great Britain.*]

Years	Estimated Population of United Kingdom	Farinaceous Substances		Vegetable Produce		Live and Dead Meat		Poultry, Game, and Fish	Butter, Cheese, Eggs, &c.	Total of all kinds
		Corn, Flour, and Meal	Rice, Sago, &c.	Sugar, Hops, and Malt	Fruit and Vegetables	Live Cattle, Sheep, and Pigs	Dead Meat, Bacon, and Hams			
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*£ s. d.*
1877 . .	33,575,941	37 10	2 7	16 11	4 1	3 7	6 7	1 2	10 10	4 3 7
1878 . .	33,943,773	34 10	2 4	12 9	4 1	4 5	7 7	1 2	11 3	3 18 5
1879 . .	34,302,557	35 9	2 6	13 9	4 2	4 2	7 11	1 2	10 6	3 19 11
1880 . .	34,622,930	36 4	2 9	13 9	4 10	5 11	9 6	1 2	12 4	4 6 7
1881 . .	34,952,204	34 10	2 8	14 5	3 5	4 10	9 4	1 7	11 10	4 2 11
1882 . .	35,297,114	36 0	2 5	15 10	3 8	5 3	7 1	1 6	11 6	4 3 3
1883 .	35,611,770	38 0	2 4	14 8	3 10	6 9	9 1	1 8	12 2	4 8 6
1884 . .	35,961,663	26 9	2 0	11 11	3 8	5 10	8 4	1 6	12 3	3 12 3
1885 . .	36,331,119	29 4	1 9	10 9	3 3	4 10	8 5	1 6	11 1	3 10 11
1886 . .	36,707,418	23 9	1 11	9 0	3 4	3 10	7 7	1 6	10 7	3 1 6

NOTE.—This Table does not include cocoa, coffee, chicory, and tea; ale, beer, wine, and spirits; dried or preserved fruit and vegetables; confectionery, isinglass, spices, sauces, and condiments; vinegar and yeast.

TABLE XI.—FOOD PRODUCTS IMPORTED INTO THE UNITED KINGDOM.

Comparative Tables showing in each of the undermentioned years the Quantities and Values of the chief Importations into the United Kingdom from Foreign Countries.

[*From Agricultural Returns of Great Britain.*]

I.—LIVE STOCK ("000" omitted).

Description	1882		1883		1884		1885		1886	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Number	£	Number	£	Number	£	Number	£	Number	£
Live Cattle	344	6,656	475	9,332	426	8,271	373	7,046	320	5,069
„ Sheep	1,124	2,559	1,116	2,519	945	2,150	751	1,625	1,039	2,010
„ Pigs	16	57	39	133	26	84	17	63	21	63
Total Live Stock	1,484	9,272	1,630	11,984	1,397	10,505	1,141	8,734	1,380	7,142

II.—DEAD MEAT, FISH, BUTTER, CHEESE, EGGS, &c. ("000" omitted).

	Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£
Beef, Mutton, and Pork (salted and fresh), Hams, &c.	4,649	12,510	6,050	16,255	5,819	15,026	6,712	15,290	6,707	13,900
Fish	1,239	2,079	1,296	2,302	1,336	2,049	1,520	1,995	1,679	2,158
Butter and Margarine	2,170	11,351	2,334	11,774	2,475	12,543	2,401	11,563	2,432	11,104
Cheese	1,695	4,750	1,800	4,890	1,927	5,002	1,834	4,070	1,735	3,871
Lard	667	1,866	854	2,247	700	1,535	871	1,606	895	1,545
Poultry and Game [1]	—	501	—	592	—	671	—	655	—	640
Eggs	—	2,385	—	2,732	—	2,910	—	2,931	—	2,884
Total value Dead Meat, &c.	—	35,442	—	40,792	—	39,736	—	38,110	—	36,102

[1] Including Rabbits in 1886.

FOOD PRODUCT IMPORTED INTO THE UNITED KINGDOM—*continued.*

III.—BREADSTUFFS, GRAIN, MEAL, SUGAR, &c. ("000" omitted).

Description	1882		1883		1884		1885		1886	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£
Wheat and Wheat-flour	77,298	44,922	80,468	43,799	62,401	30,066	77,332	33,736	62,125	26,138
Oats, Maize, Barley, Rye, &c.	52,055	18,459	69,084	23,330	56,400	17,629	65,914	19,166	63,468	17,183
Meal of all kinds	316	159	1,211	494	798	367	767	358	468	227
Rice	8,260	3,298	7,748	3,175	6,579	2,679	5,589	2,186	6,557	2,452
Sago and Sago-flour	316	219	333	220	346	196	364	183	480	229
Farinaceous substances unenumerated	—	753	—	786	—	783	—	803	—	810
Sugar and Molasses	22,813	24,992	21,023	25,097	24,299	19,820	25,138	18,461	22,936	16,000
Hops	320	2,963	120	1,089	257	1,615	267	1,002	154	447
Malt	—	3	—	2	—	1	—	3	—	12
Total value Bread-stuffs, &c.	- -	95,768	—	97,992	—	73,156	—	75,898	—	63,498

IV.—FRUIT, VEGETABLES, &c. ("000" omitted).

Description	1882		1883		1884		1885		1886	
	Bushels	£	Bushels	£	Bushels	£	Bushels	£	Bushels	£
Apples, Oranges, Lemons, &c.	9,221	3,859	9,389	3,639	10,006	3,908	9,567	3,620	10,251	3,635
Onions	3,114	528	2,687	441	3,037	532	3,538	492	3,634	507
	Cwts.		Cwts.		Cwts.		Cwts.		Cwts.	
Potatoes	2,991	997	5,150	1,585	2,444	824	2,300	728	2,708	799
Nuts (edible), including Almonds	—	702	—	687	—	828	—	702	—	696
Unenumerated	—	416	—	401	—	427	—	467	—	541
Total value Fruit, &c.	—	6,502	—	6,753	—	6,519	—	6,009	—	6,178

V.—SUMMARY VALUE OF FOOD PRODUCTS IMPORTED IN THE PERIOD 1882–86 (actual figures).

1882	1883	1884	1885	1886
£	£	£	£	£
146,983,832	157,520,797	129,916,275	128,752,604	112,919,287

TABLE XII.—NUMBER AND VALUE OF LIVE CATTLE, SHEEP, AND SWINE IMPORTED INTO THE UNITED KINGDOM IN THE UNDERMENTIONED YEARS.

[*From Trade and Navigation Returns.*]

—		Number			Value		
		1885	1886	1887	1885	1886	1887
					£	£	£
Oxen and Bulls	From Denmark . .	30,211	31,945	25,079	593,101	410,947	295,295
	„ Germany . .	14,273	6,235	7,873	272,863	97,216	123,672
	„ Spain . .	12,757	8,461	6,653	233,254	146,798	108,428
	„ Canada . .	64,443	63,407	62,537	1,292,530	1,140,800	1,089,352
	„ United States .	137,324	113,756	94,642	3,101,502	2,270,831	1,849,307
	„ Other countries	22,852	17,556	22,438	465,935	292,295	336,601
	Total . .	281,860	241,360	219,222	5,959,185	4,358,887	3,802,655
Cows	From Denmark . .	31,460	32,311	28,711	614,464	399,807	329,253
	„ Sweden . .	2,786	2,637	1,872	54,809	32,056	22,983
	„ Germany . .	4,190	2,097	2,263	72,110	31,035	32,908
	„ Canada . .	4,019	3,796	2,588	80,898	67,878	45,470
	„ United States .	507	175	215	10,395	3,352	3,567
	„ Other countries	2,432	1,937	3,117	46,028	36,924	54,882
	Total . .	45,394	42,953	38,766	878,704	571,052	489,063
Calves	From Denmark . .	6,059	4,629	4,941	22,093	15,633	16,163
	„ Holland . .	38,499	30,181	32,734	180,803	121,072	129,424
	„ Canada . .	94	45	29	248	70	58
	„ United States .	2	2	1	7	3	5
	„ Other countries	1,207	451	265	5,993	2,155	1,437
	Total . .	45,861	35,308	37,973	209,144	138,933	147,087
Sheep and Lambs	From Denmark . .	79,475	120,584	97,845	129,322	192,724	134,843
	„ Germany . .	325,553	339,719	321,085	674,279	632,365	554,596
	„ Holland . .	252,144	468,373	501,701	626,667	971,776	867,673
	„ Canada . .	39,725	94,343	35,473	80,130	184,050	65,738
	„ United States .	11,829	5,553	1,027	29,801	10,706	2,040
	„ Other countries	42,201	10,395	14,272	84,912	19,577	20,947
	Total . .	750,927	1,038,967	971,403	1,625,111	2,011,198	1,645,837
Swine	From Denmark . .	251	1,802	885	707	5,027	2,485
	„ Holland . .	15,777	18,862	20,947	60,735	56,221	61,549
	„ Canada . .	—	70	3	—	210	6
	„ United States ..	57	—	—	144	—	—
	„ Other countries	437	618	130	1,662	1,902	384
	Total . .	16,522	21,352	21,965	63,248	63,560	64,424
	Total all kinds .	1,140,564	1,379,940	1,289,329	8,735,392	7,143,430	6,149,066

TABLE XIII.—Quantity and Value of Dead Meat imported in the Four Years 1884–87.

[*From Trade and Navigation Returns.*]

Thousands ("000") omitted.

DEAD MEAT	1884		1885		1886		1887	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£
Bacon :—								
From United States	1,917	4,354	2,452	4,472	2,578	4,321	2,203	4,229
„ Other countries	839	2,430	716	1,956	678	1,822	798	2,101
Total	2,756	6,784	3,168	6,428	3,256	6,143	3,001	6,330
Beef :—								
Salted — From United States	204	401	233	443	183	304	203	310
Salted — „ Other countries	7	15	8	15	12	22	15	24
Total	211	419	241	458	195	326	218	334
Fresh — From United States	809	2,202	852	2,217	762	1,768	645	1,456
Fresh — „ Other countries	67	170	50	126	45	94	13	25
Total	876	2,372	902	2,343	807	1,862	658	1,481
Hams :—								
From United States	574	1,695	783	1,984	841	1,971	814	2,097
„ Other countries	79	236	94	252	102	266	107	293
Total	653	1,931	877	2,236	943	2,237	921	2,390
Meat, Unenumerated :—								
Salted or Fresh — From United States	2	4	3	5	2	3	6	13
Salted or Fresh — „ Other countries	18	59	27	81	40	110	41	103
Total	20	63	30	86	42	113	47	116
Preserved, otherwise than by Salting — From Australasia	127	309	199	473	57	136	167	387
Preserved, otherwise than by Salting — „ United States	260	714	261	691	293	663	228	531
Preserved, otherwise than by Salting — „ Other countries	62	369	67	370	80	368	124	432
Total	449	1,392	527	1,534	430	1,167	519	1,350
Mutton, Fresh :—								
From Holland	116	372	81	240	52	131	63	152
„ Australasia	303	821	337	834	383	842	441	925
„ Other countries	83	216	154	409	217	432	281	500
Total	502	1,409	572	1,483	652	1,405	785	1,577
Pork :—								
Salted or Fresh (not Hams) — From United States	180	308	223	334	213	295	192	275
Salted or Fresh (not Hams) — „ Other countries	157	311	159	352	159	335	236	498
Total	337	619	382	686	372	630	428	773
Total of Dead Meat	5,804	14,990	6,699	15,255	6,697	13,882	6,577	14,351

TABLE XIV.—Number of Beasts exhibited, and the Prices realised for them per Stone, at the Christmas Markets in each of the last Forty Years.

[*From the "Mark Lane Express."*]

Years	Beasts	Prices	Years	Beasts	Prices
		s. d. s. d.			s. d. s. d.
1848	5,942	3 4—4 8	1868	5,320	3 4—5 8
1849	5,765	3 4—4 0	1869	6,728	3 6—6 2
1850	6,341	3 0—3 10	1870	6,425	3 6—6 2
1851	6,103	2 8—4 2	1871	6,320	3 10—6 2
1852	6,271	2 8—4 0	1872	7,560	3 8—6 0
1853	7,037	3 2—4 10	1873	6,170	4 4—6 6
1854	6,181	3 6—5 4	1874	6,570	4 4—6 8
1855	7,000	3 8—4 2	1875	7,660	4 6—6 6
1856	6,748	3 4—5 0	1876	7,020	4 4—6 4
1857	6,856	3 4—4 8	1877	7,510	4 6—6 0
1858	6,424	3 4—5 0	1878	6,830	4 6—6 0
1859	7,560	3 6—5 4	1879	5,620	4 0—6 4
1860	7,860	3 4—5 6	1880	7,660	4 0—6 0
1861	8,840	3 4—5 0	1881	8,150	4 0—6 2
1862	8,430	3 4—5 0	1882	7,370	4 6—6 4
1863	10,372	3 6—5 2	1883	5,940	4 0—6 4
1864	7,130	3 8—5 8	1884	5,300	4 0—6 2
1865	7,530	3 4—5 4	1885	7,550	3 6—5 4
1866	7,340	3 8—5 6	1886	6,010	3 6—5 0
1867	8,110	3 4—5 0	1887	6,420	2 6—5 4

TABLE XV.—Average Annual Number of Cattle, Sheep, and Pigs brought into the London Metropolitan Cattle Market, and into the Foreign Cattle Market, in the undermentioned Periods, and in the Year 1886.

[*From Agricultural Returns of Great Britain.*]

Years	Number of Animals					Percentage of Foreign Animals
	Home	Foreign			Total	
	Metropolitan Cattle Market	Metropolitan Cattle Market	Foreign Cattle Market	Total		
	Cattle.[1]					
	Number	Number	Number	Number	Number	Per cent.
1864–71	169,955	136,366	—	136,366	306,321	44·5
[2] 1872–75	180,558	[2] 107,375	[2] 20,486	127,861	308,419	41·5
1876–80	179,253	68,179	70,399	138,578	317,831	43·6
1881–85	148,983	34,279	118,878	153,157	302,140	50·7
1886	186,580	37,930	86,969	124,899	311,479	40·1
	Sheep.[3]					
1864–71	1,113,401	459,475	—	459,475	1,572,876	29·2
[2] 1872–75	870,887	[2] 653,173	[2] 52,887	706,060	1,576,947	44·8
1876–80	789,200	210,464	551,487	761,951	1,551,151	49·1
1881–85	588,298	44,828	684,595	729,423	1,317,721	55·4
1886	674,090	68,960	707,531	776,491	1,450,581	53·5
	Pigs.					
1864–71	16,122	5,164	—	5,164	21,286	24·3
[2] 1872–75	6,391	[2] 206	[2] 9,748	9,954	16,345	60·9
1876–80	1,618	255	18,203	18,458	20,076	91·9
1881–85	602	10	16,687	16,697	17,299	96·5
1886	280	—	17,284	17,284	17,564	98·4

[1] Including Calves, but exclusive of Milch Cows.
[2] 1872 was the first complete year since the opening of the Foreign Cattle Market.
[3] Including Lambs.

TABLE XVI.—AVERAGE VALUE PER HEAD OF LIVE CATTLE, SHEEP, AND PIGS IMPORTED INTO THE UNITED KINGDOM FROM FOREIGN COUNTRIES AND BRITISH POSSESSIONS IN THE UNDERMENTIONED YEARS.

[*From Returns furnished by the Board of Customs.*]

Years	Cattle			Sheep and Lambs	Pigs
	Oxen and Bulls	Cows	Calves		
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1878	22 12 1	16 16 0	4 17 6	2 8 8	3 11 9
1879	21 17 6	16 17 9	4 14 8	2 7 8	3 9 11
1880	22 0 11	18 5 7	4 14 11	2 8 1	3 9 10
1881	21 15 2	19 9 11	4 13 1	2 6 10	3 7 5
1882	21 4 11	19 10 1	4 13 10	2 5 6	3 13 5
1883	21 11 4	19 14 3	4 13 3	2 5 1	3 8 6
1884	21 19 10	19 12 0	4 14 6	2 5 5	3 3 7
1885	21 2 10	19 6 11	4 11 2	2 3 3	3 16 6
1886	18 1 2	13 5 10	3 18 8	1 18 8	2 19 4
1887	17 6 10	12 12 4	3 17 6	1 13 11	2 18 9

TABLE XVII.—NUMBER OF HORSES, AND THEIR DECLARED VALUE, IMPORTED INTO, AND EXPORTED FROM, THE UNITED KINGDOM, IN EACH OF THE UNDERMENTIONED YEARS.

[*From Annual Statements of Trade of the United Kingdom.*]

Year	Imported		Year	Exported	
	Number	Value		Number	Value
		£			£
1882	8,827	212,074	1882	6,444	407,599
1883	10,409	212,033	1883	7,346	410,269
1884	12,929	256,789	1884	6,973	406,915
1885	13,023	195,624	1885	6,196	371,406
1886	11,026	189,901	1886	7,326	409,045
1887	11,640	198,009	1887	9,455	546,403

NOTE.—The countries from which horses were *imported* in 1886 were as follows:—Germany, 6,085; Denmark, 2,365; Holland, 915; France, 794; Belgium, 365; United States of America, 231; Canada, 118; Channel Islands, 52; Argentine Republic, 51; and 50 from other countries. The corresponding figures for 1887 have not yet been published.

TABLE XVIII.—AVERAGE PRICES OF WOOL IN EACH OF THE UNDERMENTIONED YEARS.[1]

Years	English				Australasian	South African
	Leicester	Half-breds	Kent	Southdown		
	Per lb. d. d.	Per lb. d. d.	Per lb. d. d.	Per lb. s. d. s. d.	Per lb. s. d.	Per lb. s. d.
1882	—	—	—	1s. 2d.	1 0½	1 2¼
1883	9 to 9½	9½ to 10¼	9½ to 10	0 10¾ to 1 2	1 0½	1 2¼
1884	8¾ „ 9¼	9 „ 9½	9 „ 9¾	0 10 „ 1 1½	1 0½	1 1½
1885	8½ „ 9	8¾ „ 9½	9 „ 9½	0 9 „ 1 0¼	0 10½	0 9½
1886	9 „ 9¾	9½ „ 10¼	9¾ „ 10½	0 9½ „ 1 0½	0 9¼	0 9¼
1887	9¾ „ 10¼	10 „ 11¼	10¼ „ 10¾	0 10¼ „ 1 0¾	0 10¾	0 10½

[1] The prices of English wool have been calculated from the prices given weekly in the *Economist* newspaper. The figures relating to Australasian and South African wool have been taken from Returns furnished by the Board of Customs.

TABLE XIX.—QUANTITIES OF WOOL (SHEEP, LAMB, AND ALPACA) IMPORTED INTO THE UNITED KINGDOM FROM EACH COUNTRY IN EACH YEAR, FROM 1880 to 1886 INCLUSIVE; AND THE TOTAL QUANTITIES OF FOREIGN AND COLONIAL WOOL IMPORTED AND EXPORTED IN EACH YEAR, WITH THE EXCESS OF IMPORTS.

[*From Board of Trade Returns.*]

("000" omitted.)

COUNTRIES from which exported	1880	1881	1882	1883	1884	1885	1886
Australasia:—	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
New South Wales	76,966	87,740	93,636	100,629	120,221	110,106	134,930
Queensland	13,550	15,170	20,914	25,324	29,924	31,400	25,952
South Australia	44,799	47,912	53,027	45,609	45,859	41,349	48,207
Victoria	94,513	108,807	104,389	98,828	99,355	83,201	93,890
Western Australia	2,832	3,671	3,555	3,701	4,476	5,526	5,786
Tasmania	7,003	6,997	6,609	6,758	6,159	5,868	5,452
New Zealand	60,964	59,369	63,654	70,837	75,410	78,606	87,208
Australasia.—Total	300,627	329,666	345,784	351,686	381,404	356,056	401,425
Argentine Confederation	2,612	655	2,693	1,221	538	2,784	6,697
Belgium	5,034	3,613	5,338	5,265	3,854	4,585	3,441
Cape of Good Hope	42,226	42,707	47,538	41,095	41,076	33,986	48,194
Chili	2,532	1,723	1,258	649	1,593	1,531	732
Denmark	2,029	2,499	1,191	2,158	1,471	1,920	1,997
Egypt	2,817	1,987	1,487	2,699	2,087	2,376	3,838
Falkland Islands [1]	—	—	—	—	—	—	2,499
France	9,057	3,018	4,948	5,338	5,586	7,621	11,465
Germany	7,174	2,264	2,728	4,339	1,690	1,887	3,288
Holland	2,805	1,520	581	451	810	683	2,756
India, British	29,190	22,215	26,924	24,822	24,799	25,697	34,597
Morocco	2,954	806	2,769	2,633	896	572	1,390
Natal	9,160	6,824	6,338	7,776	10,259	13,028	13,063
Peru	2,557	3,134	6,052	2,427	11,427	6,270	5,789
Portugal	2,965	1,539	1,961	1,970	1,428	1,491	2,495
Russia North	6,019	2,786	2,889	3,476	2,508	5,161	4,092
Russia South	14,063	13,009	14,649	24,672	20,492	24,488	25,630
Turkey	12,432	6,719	9,400	8,690	10,378	11,113	17,965
Other Countries	7,256	3,458	4,457	4,580	4,231	4,439	5,118
Total imported	463,509	450,142	488,985	495,947	526,527	505,688	596,471
Total exported [2]	237,409	265,584	263,966	277,234	276,919	267,502	312,006
Excess of Imports	226,100	184,558	225,019	218,713	249,608	238,186	284,465

[1] The Falkland Islands were included with "Other Countries" prior to 1886.
[2] Foreign and Colonial only.

TABLE XX.—QUANTITIES OF CERTAIN ARTICLES OF FOREIGN AND COLONIAL PRODUCTION IMPORTED IN THE YEARS 1884–87.

[*From Trade and Navigation Returns.*]

	1884	1885	1886	1887
Bones (burnt or not, or as animal charcoal) . tons	72,640	64,140	57,175	51,882
Cotton, Raw . . cwts.	15,505,851	12,586,009	15,187,299	15,903,117
Flax . . . . . „	1,606,966	1,664,836	1,287,034	1,560,696
Guano . . . tons	48,284	24,757	68,744	21,251
Hemp . . . cwts.	1,334,924	1,446,398	1,213,857	1,472,857
Hops . . . . . „	257,374	266,473	153,788	145,298
Hides untanned: Dry „	646,842	672,878	721,964	627,132
„ „ Wet „	572,189	555,114	499,271	523,393
Petroleum . . . gallons	52,808,436	73,869,787	71,026,962	77,458,062
Oilseed Cakes . . tons	269,235	283,052	296,530	265,694
Potatoes . . . cwts.	2,444,073	2,300,824	2,709,444	2,762,958
Lard . . . . . „	698,397	869,842	896,324	906,190
Clover and Grass Seeds „	290,022	315,803	289,214	335,858
Flax-seed and Linseed qrs.	1,805,535	2,056,263	2,081,283	2,341,175
Rape . . . . . „	769,813	544,275	372,613	413,856
Sheep and Lambs' Wool lbs.	519,555,493	501,182,161	591,872,167	574,196,058

TABLE XXI.—QUANTITIES OF UNMANUFACTURED TOBACCO IMPORTED INTO THE UNITED KINGDOM FROM EACH COUNTRY IN EACH OF THE YEARS 1882–86.

[*From Annual Statements of Trade of United Kingdom.*]

	1882	1883	1884	1885	1886
	lbs.	lbs.	lbs.	lbs.	lbs.
Germany . . .	777,583	1,378,579	1,464,350	1,384,106	924,560
Holland . . .	8,243,589	6,655,548	5,728,744	6,478,410	5,077,642
Turkey . . .	1,422,386	1,539,654	1,114,143	1,902,542	2,732,438
China and Hong Kong	614,492	854,547	1,813,221	1,507,213	1,539,913
Japan . . .	1,093,291	902,981	1,876,787	5,400,127	1,391,810
Columbia, United States of . .	—	230,590	122,570	160,029	100,807
United States . .	21,878,817	42,370,653	37,186,980	60,247,715	70,458,667
Other Countries . .	2,045,212	2,542,647	4,223,612	2,043,197	992,145
Total . .	36,075,370	56,475,199	53,530,407	79,123,339	83,217,982

NOTE.—The total quantity of Unmanufactured Tobacco imported from all countries in 1887 was 70,552,317 lbs.

TABLE XXII.—QUANTITIES AND VALUE OF BUTTER, MARGARINE, FOLLOWING COUNTRIES IN

[*From Trade and*

("000"

Description	Year	Belgium and Holland		Canada		Denmark and Norway	
		Quantity, Cwts.	Value, £	Quantity, Cwts.	Value, £	Quantity, Cwts.	Value, £
		thousands	thousands	thousands	thousands	thousands	thousands
Butter . . .	1883	1,039	4,466	*	*	354	2,152
	1884	1,172	5,260	54	250	335	2,008
	1885	308	1,661	36	146	377	2,118
	1886	359	1,775	31	120	401	2,195
	1887	165	851	33	139	488	2,669
Margarine . . [Shown as Butterine before passing of Act of 1887.]	1883	†	†	—	—	†	†
	1884	†	†	—	—	†	†
	1885	813	2,938	—	—	17	70
	1886	854	2,837	—	—	21	83
	1887	1,195	3,617	—	—	17	62
Cheese . . .	1883	293	825	*	*	—	—
	1884	319	892	590	1,497	—	—
	1885	336	833	606	1,230	—	—
	1886	318	765	508	1,116	—	—
	1887	362	884	632	1,553	—	—
		thousands of great hundreds	thousands £	thousands of great hundreds	thousands £	thousands of great hundreds	thousands £
Eggs	1883	—	—	—	—	—	—
	1884	2,093	710	—	—	—	—
	1885	2,083	706	—	—	—	—
	1886	1,956	654	—	—	—	—
	1887	1,678	553	—	—	—	—

* Included under head of "Other Countries."

CHEESE, AND EGGS IMPORTED INTO THE UNITED KINGDOM FROM THE
THE YEARS INDICATED.

Navigation Returns.]

omitted.)

FRANCE		GERMANY		UNITED STATES		OTHER COUNTRIES		TOTAL IMPORTS	
Quantity, Cwts.	Value, £	Quantity, Cwts.	Value, £	Quantity, Cwts.	Value, £	Quantity, Cwts.	Value, £	Quantity, Cwts.	Value, £
thousands	thousands	thousands	thousands	thousands	thousands	thousands	thousands	thousands	thousands
503	2,832	*	*	120	562	317	1,762	2,333	11,774
510	2,895	147	864	100	448	155	801	2,473	12,526
451	2,579	143	789	78	314	160	899	1,553	8,506
403	2,264	119	612	42	160	188	1,014	1,543	8,140
416	2,265	156	794	52	214	205	1,085	1,515	8,017
—	—	—	—	—	—	†	†	†	†
—	—	—	—	—	—	†	†	†	†
—	—	—	—	—	—	17	47	847	3,055
—	—	—	—	—	—	12	39	887	2,959
—	—	—	—	—	—	61	191	1,273	3,870
*	*	—	—	991	2,696	513	1,369	1,797	4,890
27	90	—	—	975	2,478	15	41	1,926	4,998
30	96	—	—	844	1,864	17	42	1,833	4,065
32	103	—	—	855	1,834	20	50	1,733	3,868
30	100	—	—	759	1,847	51	125	1,834	4,509
thousands of great hundreds	thousands £	thousands of great hundreds	thousands £	thousands of great hundreds	thousands £	thousands of great hundreds	thousands £	thousands of great hundreds	thousands £
—	—	—	—	—	—	—	—	9,404	2,732
3,265	1,304	2,267	683	—	—	651	212	8,276	2,909
3,339	1,342	2,280	672	—	—	650	209	8,352	2,929
3,208	1,215	2,581	744	—	—	868	266	8,613	2,879
3,071	1,252	3,210	944	—	—	1,111	332	9,070	3,081

† Included with "Butter" returns previous to 1885.

TABLE XXIII.—PRINCIPAL CORN CROPS OF THE WORLD.

Comparative statements (*partly estimated*) showing the Acreage (English Statute Measure) of Land under Wheat, Barley, Oats, and Maize respectively; the produce thereof, and the yield per acre, in the undermentioned countries in the years 1884, 1885, 1886.

[*From Statistical Abstracts of United Kingdom.*]

(A) WHEAT.

NAME OF COUNTRY	1884			1885			1886		
	Acreage, "000" omitted	Produce, "000" omitted	Yield per acre	Acreage, "000" omitted	Produce, "000" omitted	Yield per acre	Acreage, "000" omitted	Produce, "000" omitted	Yield per acre
	Acres	Bush.	Bush.	Acres	Bush.	Bush.	Acres	Bush.	Bush.
United Kingdom	2,745	82,067	29·9	2,549	79,636	31·2	2,355	63,348	26·9
Australasia [1]	1,721	22,736	13·2	1,532	17,096	11·2	1,718	25,209	14·7
Austria-Hungary: Austria	2,734	42,464	15·5	2,919	46,793	15·9	—	—	—
Austria-Hungary: Hungary	6,795	103,902	15·3	6,769	110,296	16·3	6,827	99,675	14·6
Belgium	—	15,988	—	—	16,641	—	—	—	—
Canada [2]	1,893	41,501	21·9	2,012	37,597	18·4	1,848	33,310	18·0
Denmark	—	4,784	—	—	5,326	—	—	5,007	—
France	[3]17,419	[3]314,135	[3]18·0	[3]17,183	[3]302,120	[3]17·6	—	—	—
Germany	4,740	91,058	19·2	4,727	95,180	20·2	4,734	97,917	20·7
Holland	219	5,710	26·0		—	—		—	—
India	27,620	287,956	10·4	27,393	288,938	10·5	26,735	238,586	8·9
Italy	—	123,884	—	—	114,598	—		125,421	—
Russia in Europe	—	258,562	—	—	172,378	—		—	—
Sweden	[4]1,100	3,676	—	[3]1,073	3,767	—	—	3,656	—
United States of America [5]	39,476	497,098	12·6	34,189	346,201	10·1	36,806	443,249	12·0

[1] Exclusive of South Australia, figures for that colony not being available.
[2] Ontario and Manitoba only.
[3] Including spelt.
[4] Including rye.
[5] The produce for the United States, which was originally given in Winchester Bushels, has been converted into the equivalent quantities in Imperial Bushels.

(B) Barley.

Name of Country	1884 Acreage, "000" omitted	1884 Produce, "000" omitted	1884 Yield per acre	1885 Acreage, "000" omitted	1885 Produce, "000" omitted	1885 Yield per acre	1886 Acreage, "000" omitted	1886 Produce, "000" omitted	1886 Yield per acre
	Acres	Bush.	Bush.	Acres	Bush.	Bush.	Acres	Bush.	Bush.
United Kingdom	2,336	79,917	34·2	2,437	85,722	35·2	2,423	78,310	32·3
Australasia [1]	121	2,714	22·4	127	2,561	20·1	73	1,682	22·9
Austria-Hungary { Austria	2,654	50,133	18·9	2,881	50,448	17·5	—	—	—
Austria-Hungary { Hungary	2,459	45,370	18·4	2,583	52,638	20·4	2,579	36,696	14·2
Belgium	—	3,640	—	—	5,547	—	—	—	—
Canada [2]	741	20,143	27·2	650	17,867	27·5	805	20,476	25·4
Denmark	—	20,456	—	—	22,346	—	—	23,293	—
France	2,612	53,464	20·5	2,360	47,892	20·3	—	—	—
Germany	4,286	98,281	22·9	4,297	99,649	23·2	4,277	103,024	24·1
Holland	116	4,736	40·7	—	—	—	—	—	—
India	—	—	—	—	—	—	—	—	—
Italy	—	13,235 [3]	—	—	12,394 [3]	—	—	—	—
Russia in Europe	—	128,948	—	—	97,170	—	—	—	—
Sweden	2,544 [4]	16,218	—	2,604 [4]	13,048	—	—	15,445	—
United States of America [5]	2,609	59,333	22·7	2,729	56,577	20·7	—	—	—

[1] Exclusive of South Australia, figures for that colony not being available. [2] Ontario and Manitoba only.
[3] Including rye. [4] Including oats and mixed corn.
[5] The produce for the United States, which was originally given in Winchester Bushels, has been converted into the equivalent quantities in Imperial Bushels.

TABLE XXIII. (*continued*).—(C) OATS.

Name of Country.	1884 Acreage, "000" omitted	1884 Produce, "000" omitted	1884 Yield per acre	1885 Acreage, "000" omitted	1885 Produce, "000" omitted	1885 Yield per acre	1886 Acreage, "000" omitted	1886 Produce, "000" omitted	1886 Yield per acre
	Acres	Bush.	Bush.	Acres	Bush.	Bush.	Acres	Bush.	Bush.
United Kingdom	4,264	161,404	37·8	4,269	160,441	37·6	4,404	169,376	38·5
Australasia [1]	593	18,037	30·4	591	14,384	24·3	620	17,421	28·1
Austria-Hungary: Austria	4,531	104,525	23·1	4,518	91,822	20·3	—	—	—
Austria-Hungary: Hungary	2,457	55,324	22·5	2,564	52,764	20·6	2,602	53,293	20·5
Belgium	—	25,090	—	—	24,952	—	—	—	—
Canada [2]	1,615	61,760	38·2	1,701	60,764	35·7	1,783	62,138	34·8
Denmark	—	29,127	—	—	31,777	—	—	32,762	—
France	9,132	242,216	26·5	9,113	235,208	25·8	—	—	—
Germany	9,308	239,426	25·7	9,329	245,399	26·3	9,402	274,420	29·2
Italy	—	14,558	—	—	15,255	—	—	—	—
Russia in Europe	—	485,353	—	—	376,486	—	—	—	—
Sweden	—	54,662	—	—	49,899	—	—	52,929	—
United States of America [3]	21,301	565,796	26·6	22,784	610,179	26·8	23,658	605,065	25·6

(D) MAIZE.

Name of Country.	1884 Acreage	1884 Produce	1884 Yield per acre	1885 Acreage	1885 Produce	1885 Yield per acre	1886 Acreage	1886 Produce	1886 Yield per acre
Australasia [1]	181 [4]	4,480 [4]	24·8 [4]	209 [4]	5,993 [4]	28·6 [4]	228 [4]	5,770 [4]	25·3 [4]
Austria-Hungary: Austria	875	16,478	18·8	908	19,272	21·2	—	—	—
Austria-Hungary: Hungary	4,583	87,549	19·1	4,632	105,729	22·8	4,728	81,861	17·3
Canada [2]	175	12,935 [5]	—	168	14,741 [5]	—	157	10,805 [5]	—
France	1,627 [6]	28,658 [6]	17·6 [6]	1,507 [6]	26,828 [6]	17·8 [6]	—	—	—
Italy	—	82,770	—	—	77,429	—	—	77,791	—
Russia in Europe	—	15,603	—	—	16,705	—	—	—	—
United States of America [3]	69,684	1,740,670	25·0	73,130	1,877,020	25·7	75,694	1,614,557	21·3

[1] Exclusive of South Australia, figures for that colony not being available. [2] Ontario and Manitoba only.
[3] The produce for the United States, which was originally given in Winchester Bushels, has been converted into the equivalent quantities in Imperial Bushels.
[4] Colonies of New South Wales, Victoria, Western Australia, and Queensland only. [5] In ear. [6] Including millet.

TABLE XXIV.—Principal Live-Stock Returns of the World.

Comparative Tables showing the number of Horses, Cattle, Sheep, and Pigs in the undermentioned Countries[1] for each of years indicated.—[*From Board of Trade Returns*.]
("000" omitted.)

Year (unless otherwise specified in heading)	United Kingdom	British Possessions: Australasia	Canada[2]	Ceylon	Natal	Foreign Countries: Austria (1869 and 1880)	Austria-Hungary	Belgium (1880)	Denmark (1881)	France	Germany (1883)	Holland	Italy (1881–2)	Norway (1875)	Russia in Europe (1883)	Sweden	United States of America
I.—Horses.																	
1884	1,901	1,279	556	4	43	1,381	1,749	272	318		3,522	269	660	152	—	476	11,564
1885	1,909	1,325	585	4	49	1,463	—	—	—	2,911	—	—	—	—	17,881	480	12,078
1886	1,927	1,373	593	—	50	—	—	—	—	—	—	—	—	—	—	—	12,497
II.—Horned Cattle.																	
1884	10,422	8,273	1,990	964	576	7,422	4,879	1,383	1,470		15,787	1,474	4,783	1,017	—	2,327	43,771
1885	10,868	8,203	2,069	951	601	8,581		—		13,105	—	—	—	—	23,628	2,366	45,511
1886	10,872	8,229	2,106	—	630	—					—	—	—	—	—	—	48,034
III.—Sheep and Lambs.																	
1884	29,377	75,632	1,897	54	561	5,026	10,595	365	1,549	—	19,190	753	8,596	1,686	—	1,410	50,360
1885	30,086	82,158	1,766	47	535	3,841	—	—	—	22,616	—	—	—		46,725	1,412	48,322
1886	28,955	81,855	1,624	—	676	—	—	—	—	—	—	—	—		—	—	44,759
IV.—Pigs.																	
1884	3,906	940	961	—	26	2,552	4,801	616	527	—	9,206	427	1,164	101	—	477	45,143
1885	3,686	1,037	888	—	23	2,722	—	—	—	5,881	—	—	—	—	9,362	516	46,092
1886	3,497	1,053	919	—	33	—	—	—	—	—	—	—	—	—	—	—	44,613
V.—Horses, Cattle, Sheep, and Pigs.																	
1884	45,609	86,124	5,404	1,022	1,206	16,384	22,027	2,666	3,894		47,705	2,923	15,203	2,956	—	4,690	150,838
1885	46,549	92,723	5,308	1,002	1,208	16,610	—		—	44,513	—	—	—	—	97,596	4,804	152,003
1886	45,251	95,510	5,242	—	1,389	—	—		—	—	—	—	—	—	—	—	149,903

[1] The Board of Trade Returns have no information about Live-Stock of India and several Foreign Countries.
[2] Returns published only relate to Provinces of Ontario and Manitoba.

TABLE XXV.—Prices of Butter and Cheese in London during the First Week of January of each of the Ten Years 1879–88.

[*From "The Grocer."*]

BUTTER.

	1888	1887	1886	1885	1884
Butter (per cwt.) :—	*s.* *s.*	*s.* *s.*	*s.* *s.*	*s.* *s.*	*s.* *s.*
Cork 1sts . .	— —	— —	— —	— —	134 to 143
2nds . .	112 to 116	124 to —	117 to —	119 to 136	130 „ 136
3rds . .	91 „ —	102 „ —	75 „ —	89 „ 91	94 „ —
4ths . .	76 „ —	84 „ —	50 „ —	58 „ —	70 „ —
Normandy . .	100 „ 112	90 „ 134	80 „ 144	100 „ 142	97 „ 144
Dutch, or Friesland	100 „ 122	80 „ 116	— —	— —	124 „ 136
American . .	50 „ 116	76 „ 116	60 „ 112	80 „ 124	75 „ 122
Bosch, &c. . .	— —	44 „ 90	40 „ 90	45 „ 90	40 „ 80
	1883	**1882**	**1881**	**1880**	**1879**
Cork 1sts . .	— —	136 to 140	141 to 143	145 to —	126 to 133
2nds . .	— —	129 „ 131	138 „ 141	143 „ —	116 „ 121
3rds . .	115 to —	111 „ 113	104 „ 107	110 „ —	78 „ 80
4ths . .	89 „ —	82 „ —	77 „ 78	97 „ —	— —
Normandy . .	110 „ 150	110 „ 150	108 „ 150	110 „ 130	75 „ 136
Dutch . . .	134 „ 144	125 „ 144	120 „ 130	124 „ 130	116 „ 120
American . .	— —	60 „ 122	95 „ 130	90 „ 130	50 „ 110
Bosch, &c. . .	60 „ 90	50 „ 85	65 „ 84	65 „ 90	56 „ 70

CHEESE.

	1888	1887	1886	1885	1884
Cheese (per cwt.) :—	*s.* *s.*	*s.* *s.*	*s.* *s.*	*s.* *s.*	*s.* *s.*
English . . .	46 to 78	38 to 78	54 to 78	64 to 85	64 to 86
American . .	40 „ 62	36 „ 64	34 „ 54	45 „ 68	40 „ 68
Gouda . . .	46 „ 52	40 „ 46	50 „ 54	40 „ 52	54 „ 64
Edam . . .	56 „ 60	50 „ 54	46 „ 52	54 „ 62	61 „ 66
	1883	**1882**	**1881**	**1880**	**1879**
English . . .	62 to 82	60 to 82	70 to 90	66 to 86	40 to 84
American . .	46 „ 70	42 „ 68	56 „ 72	56 „ 70	24 „ 53
Gouda . . .	54 „ 62	56 „ 62	60 „ 68	56 „ 62	48 „ 56
Edam . . .	56 „ 64	57 „ 64	62 „ 68	60 „ 64	46 „ 56

DAIRY PRODUCE, 1887.

The following remarks have appeared in the "Grocer":—

Irish Butter.—A good demand has mostly been experienced for this description of butter, as there are still some classes of consumers who will have this in preference to any other, and, in spite of severe foreign competition, large quantities have been landed and delivered in London at relatively full rates. In the early months first 'Corks,' as usual, were not to be had, but seconds were quoted 127*s.* to 130*s.*, thirds 104*s.* to 105*s.*, and fourths 89*s.* per cwt. New season's makes in April were offering at a considerable reduction, when firsts were sold at 107*s.*, seconds at 102*s.*, thirds at 80*s.*, and fourths at 76*s.*; but this was followed by a much heavier decline, when 88*s.*, 74*s.*, 64*s.*, and 56*s.* respectively became the current rates; and in June the lowest point of the year was touched, when first quality was realised at 79*s.*, second at 68*s.*, third at 61*s.*, and fourth at 52*s.* In accordance with the moves in previous seasons, prices for Cork butter rose 12*s.* to 15*s.* per cwt. in July, and again rapidly advancing in August, were then ruling at 118*s.* to 120*s.* for firsts, 114*s.* to 116*s.* for seconds, 106*s.* to 110*s.* for thirds, and 90*s.* to 97*s.* for fourths, being the best terms that were obtained since the commencement of 1887. Latterly the tendency has been in favour of the buyer, and in November sales were practicable only at 113*s.* for first Corks, at 100*s.* for seconds, at 95*s.* for thirds, and at 82*s.* for fourths. For a short time in December, 128*s.* was the top price for finest quality, and 117*s.* for seconds, but no firsts are now (January 1888) offering, and the third and fourth grades can be had at 94*s.* and 76*s.* per cwt.

Foreign Butter.—The importations have nearly equalled those in 1886, and heavier quantities are received from Denmark, France, and Germany, those from Holland having materially diminished, whilst from other countries the consignments have been small and irregular. The opening rates for Normandy butter last year were:—For baskets 106*s.* to 120*s.*, firkins 108*s.* to 116*s.*, and seconds 90*s.* to 96*s.*; but in March the finest quality fetched 116*s.* to 138*s.* per cwt., though other kinds were procurable at some concessions. However, in April, more weakness began to show itself, and shortly afterwards the following rates were accepted:—For baskets 100*s.* to 112*s.*, firkins 96*s.* to 102*s.*, and seconds 78*s.* to 84*s.*; but the lowest figures were established in June, when butter in baskets was purchased at 92*s.* to 102*s.*, in firkins at 88*s.* to 92*s.*, and seconds at 74*s.* to 78*s.* After that there was a smart reaction of 10*s.* per cwt., which was thrice repeated in July, August, and September, and the total advance having since been fairly well maintained, the final rates in November and December were as under:—For baskets 112*s.* to 134*s.*, firkins 112*s.* to 128*s.*, and seconds 110*s.* down to 96*s.* Danish butter has moved much in proportion, at first

selling at 116*s.* to 124*s.* for the choicest quality, subsequently dropping to 98*s.* and 90*s.*, then rallying to 108*s.*, 122*s.*, and to 130*s.* and 134*s.*, but the closing quotations were 116*s.* to 120*s.* American has ranged from 50*s.* to 66*s.* at the worst period, to 80*s.* and 116*s.* at the best, with other sorts and substitutes (chiefly under the exploded terms of "Bosch" and "Butterine," now Margarine) in proportion.

CHEESE.—So far as can be proved by the quantity actually imported into the United Kingdom, the supplies of cheese during the past year have been quite as abundant as those in 1886, and whatever 'shortage' there may have been, it must have existed more in the home production than in foreign descriptions. Be this as it may, the prices for American—one of the leading kinds of cheese—have been above those of the former year, and during the first half of 1887, while the value of the finer grades stood at 56*s.* to 67*s.*, that of the medium and lower qualities was not less than 36*s.* to 50*s.* During a temporary depression in July, however, the quotations were only 36*s.* to 51*s.*, but they afterwards soon mounted upwards, and have towards the close been advanced to 46*s.* to 64*s.*, the very latest rates being 40*s.* to 62*s.* per cwt. Edam cheese in the earlier months realised 50*s.* to 60*s.*, but later on was not worth more than 46*s.* to 52*s.*, though, in common with other goods, it has since been taken at much firmer prices—56*s.* to 60*s.* Goudas have varied in price from 40*s.* to 49*s.* early in the year, to between 36*s.* and 42*s.* at the dullest period, and to 44*s.* and 52*s.* per cwt. within the last few months. Singularly enough, English cheese in London has not undergone many changes in quotations, having been only partially affected by the more favourable reports from the country fairs and elsewhere, and is now on offer at prices differing but slightly from those of a twelvemonth since.

MARGARINE.—The Margarine Act is now in force, and if a customer asks his grocer for butterine his grocer will be unable to supply it, but will have to inform him that he can let him have practically the same article under the name of margarine, duly labelled in the style prescribed by law. We do not anticipate that there will be many prosecutions under the new Act, as the trade are, for the most part, thoroughly familiar with its provisions, and know what the law expects of them. It will, no doubt, be the small shopkeepers who will be chiefly proceeded against, as unfortunately these do not take the trouble to make themselves acquainted even with legal measures directly affecting their own interests.

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ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

I.—*The Permanent Wheat and Barley Experiments in Stackyard Field, Woburn.* By Sir John Lawes, Bart., Rothamsted, St. Albans.

The permanent wheat and barley experiments in Stackyard Field, Woburn, were commenced in the year 1877, and as the results up to 1886 have already been published in the 'Journal of the Royal Agricultural Society,' it appears desirable that some general review of these results should be drawn up.

The influence of climate upon our crops is so vast, and the fluctuation in the seasons so great, that any conclusion drawn from the produce of one or two years is very apt to be misleading. Although the average climate of any ten years is not necessarily the exact counterpart of the preceding or succeeding ten years, still we may safely make use of the figures obtained from a ten years' average, to bring out several very important agricultural facts, provided that the original arrangement of the experiments has not been subject to any serious alterations.

With regard to the experiments in Stackyard Field, the original plan for carrying them out was well adapted to elicit information respecting the action of manures upon both wheat and barley; also to throw some light upon the store of fertility existing in the soil. This plan has been carried out either without change, or, where any change has been made, the result has been to bring out some very interesting facts. In the following table will be found a summary of the results of the continuous growth of wheat and barley for ten years, 1877–1886. It also gives the highest and lowest yield in any one year; the mean of the highest and lowest years; the general mean of ten years; the weight per bushel of dressed corn; and the weight of straw:—

EXPERIMENTS CONDUCTED YEAR AFTER YEAR ON THE SAME LAND, STACKYARD FIELD, WOBURN.

Mean Results for 10 *Years,* 1877–1886: *Quantities per Acre.*

PLOT	MANURES	DRESSED GRAIN					STRAW
		BUSHELS				Weight per bushel	
		Highest yield	Lowest yield	Mean of Highest & Lowest	General mean		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	WHEAT.						
						lbs.	cwts.
1	Unmanured	25·7	9·6	17·7	16·8	56·4	$17\frac{5}{8}$
7	Unmanured	26·6	7·5	17·1	17·4	56·3	$17\frac{1}{8}$
4	Mixed Mineral Manure	28·2	10·4	19·3	17·7	56·8	$18\frac{1}{4}$
2	200 lbs. Ammonium-salts	40·3	11·5	25·9	25·4	56·5	$24\frac{3}{4}$
3	275 lbs. Nitrate of Soda	41·0	10 5	25·8	24·1	54·8	$25\frac{1}{4}$
5	Mixed Mineral Manure and 200 lbs. Amm.-salts (in spring)	46·1	13·0	29·6	31·5	57·8	32
6	Mixed Mineral Manure and 275 lbs. Nitrate of Soda (in spring)	45·2	14·0	29·6	32·4	57·8	$34\frac{5}{8}$
[1] 8*b*	Mixed Mineral Manure and 400 lbs. Amm.-salts	48·8	27·0	37·9	38·8	58·2	$42\frac{1}{8}$
8*a*	Mixed Mineral Manure	32·5	13·3	22·9	[3]20·4	[3]58·6	[3]$17\frac{7}{8}$
[2] 9*b* or	Mixed Mineral Manure and 550 lbs. Nitrate of Soda	51·0	26·1	38·6	37·2	57·8	$44\frac{1}{4}$
9*a*	Mixed Mineral Manure	21·9	12·2	17·1	[3]17·1	[3]58·2	[3]$17\frac{1}{8}$
	BARLEY.						
1	Unmanured	34·1	19·1	26·6	26·9	51·8	$15\frac{5}{8}$
7	Unmanured	33·3	13·0	23·2	23·0	51·0	$13\frac{5}{8}$
4	Mixed Mineral Manure	33·6	11·8	22·7	23·3	51·8	$13\frac{1}{2}$
2	200 lbs. Ammonium-salts	51·2	27·1	39·2	39·4	52·0	$23\frac{1}{8}$
3	275 lbs. Nitrate of Soda	51·6	21·5	36·6	40·4	51·7	$25\frac{1}{8}$
5	Mixed Mineral Manure and 200 lbs. Amm.-salts (in spring)	51·9	28·7	40·3	43·0	53·4	$26\frac{1}{8}$
6	Mixed Mineral Manure and 275 lbs. Nitrate of Soda (in spring)	57·8	27·3	42·6	46·0	53·0	$30\frac{1}{8}$
8*b* or	Mixed Mineral Manure and 400 lbs. Amm.-salts	62·5	30·8	46·7	51·2	52·9	$33\frac{1}{2}$
8*a*	Mixed Mineral Manure	46·4	26·5	36·5	[3]37·0	[3]53·6	[3]$21\frac{1}{8}$
[2] 9*b* r	Mixed Mineral Manure and 500 lbs. Nitrate of Soda	66·8	37·0	51·9	53·3	52·4	$38\frac{1}{4}$
9*a*	Mixed Mineral Manure	37 2	37·7	32·5	[3]34·5	[3]53·8	[3]$18\frac{1}{4}$

[1] Only one plot from 1877 to 1881 inclusive. In 1882 and since, it has been divided into "*a*" and "*b*" portions, and the manures alternated each year. One half (8*a*) in that year (1882) received Mineral Manure alone, and the other half (8*b*) received 400 lbs. Ammonium-salts in addition (as applied to the full plot in previous years). In 1883, 8*a* received the minerals and ammonium-salts, and 8*b* the minerals alone, and so on, alternating each year.

[2] The same plan adopted as for plot 8, with the exception that 550 lbs. Nitrate of Soda were applied instead of the 400 lbs. Ammonium-salts.

[3] Average of five years only, 1882–1886.

Taking first the result of the wheat experiment, it will be seen how extraordinary is the influence of climate upon a crop which is treated in every respect in the same way year after year. On the unmanured plots we have three times as much produce in one year as we have in another. On the plot manured with nitrate of soda alone the produce in one year was $10\frac{1}{2}$ bushels, and in another 41 bushels per acre; thus, one season in this case gives four times as large a crop as another. Differences so great prove conclusively the necessity of carrying on experiments without change for a number of years, as also the impossibility of drawing conclusions of any value from experiments which, however carefully they may have been conducted, have only been carried on for one or two years.

In the fifth column of the table is given the mean produce of the highest and lowest crops of the ten years, while the sixth column gives the mean of the whole ten crops. It is the latter column to which my remarks will apply. It may, however, be worth while to observe that the mean of the best and worst years frequently gives a produce which closely resembles the mean of the whole period.

Omitting 8*a* and 9*a*, which were only under experiment for five years, the mean of the other nine experiments gives products absolutely identical; that is, 26·8 bushels both for the mean of the highest and lowest product and the general mean. The two unmanured plots, in which the difference is very small, give a produce of rather more than 17 bushels per acre, while a manure which supplied all the mineral ingredients for a large crop has produced no appreciable difference. On the other hand, manures such as salts of ammonia and nitrate of soda, which supply nitrogen, but neither phosphoric acid nor potash, increase the yield by 6 or 7 bushels per acre. When the minerals used on plot four are added to the ammonia, or to the nitrate of soda in plots two and three, we find the produce raised to $31\frac{1}{2}$ and $32\frac{1}{2}$ bushels per acre. With the same mineral manures, but with twice the quantity of salts of ammonia and nitrate of soda, the plot which received the salts of ammonia yielded nearly 39 bushels per acre, and that which received nitrate of soda a little over 37 bushels per acre.

Speaking in general terms, the mineral manures have added nothing to the unmanured crop, while nitrogen as ammonia or as nitric acid, applied without minerals, has increased the crop by seven bushels. When minerals have been used with the same nitrogen, another seven bushels have been added to the crop, and when twice the amount of nitrogen has been used with the minerals, nearly seven bushels more have been added to the crop. In all the experiments the weight per bushel of

dressed grain is low, and this will generally be found to be the case wherever wheat is grown continuously on the same soil. In all of the experiments where nitrate of soda was used, the amount of straw is greater than where salts of ammonia were used.

Turning now to the barley, although the influence of season is still considerable, it will be seen that the fluctuations due to this cause are very much less than in the case of the wheat. This is the result of the barley being sown in the spring, and thus escaping the vicissitudes of the winter months. Further, the climate of Great Britain is far more suitable for the growth of barley than that of wheat, and to this may be added that the soil of Stackyard Field is in its texture far more suitable for the growth of barley. For all these reasons it might be expected that the crops of barley, both the manured and the unmanured, would be superior to those of the wheat. From some cause, possibly some slight difference in the texture of the soil, the two unmanured plots differ considerably, one yielding close upon 27 bushels per acre and the other 23 bushels. As the plot which received the mixed mineral manures only gave 23 bushels per acre, it is probable that this produce more nearly represents the yield of the unmanured plot than the other. As in the case of the wheat, the mineral manure alone produces no increase in the yield of the crop. While, however, the addition of salts of ammonia and nitrate of soda added only 7 bushels to the produce of the wheat, these salts have added 16 and 17 bushels respectively to the barley crop. This large increase in barley over wheat by means of ammonia and nitrate alone is doubtless due to the difference in the character of the roots of the two plants. Wheat requires a solid bed, and its roots descend deep into the subsoil, while the barley requires a fine tilth, and its roots take much of the food near the surface.

It is the surface soil in Stackyard Field which contains a large amount of fertility. While, therefore, the application of ammonia or nitrate to the unmanured plots increases the crop by 16 to 17 bushels, the addition of minerals has only added to it, in one case $3\frac{1}{2}$ bushels, and in the other case 6 bushels. Doubling the salts of ammonia adds 7 bushels to the crop, producing 51 bushels, while doubling the nitrate of soda also adds 7 bushels to the crop, producing 53·3 bushels per acre. In all these instances nitrate of soda has given a greater increase in the grain and straw of the barley crop than the salts of ammonia, whereas in the wheat the nitrate always gave the largest increase in the straw, but not so in the grain. A general examination of the wheat and barley experiments shows a remarkable agreement in the results, and, when they appear to

differ, this difference may be explained by the different character of the two cereals.

It may appear at first sight strange that while the unmanured wheat only yielded 17 bushels per acre, the barley should yield 23 bushels; but if, instead of taking the bushel of grain as our measure, we take the total weight of the crops grown—straw and corn—we shall find very little difference in the weights. Wheat has a tendency to grow a larger proportion of straw to a given weight of grain than is the case with barley. If we take the highest yield of the two crops, in which the barley grew 16 bushels per acre more than the wheat, the total produce—corn and straw—in the wheat amounted to 7,106 lbs. per acre, while in the barley it was 7,077. The manure has, therefore, done an equal amount of work in both cases, the same amount of dry matter has been produced, and the same amount of carbonic acid has been decomposed and carbon fixed in the plant. The only difference between them is, that, owing to the characteristic habits of each plant, one produces more straw in proportion to its grain than the other.

One of the important facts brought out with great clearness in these experiments is the absolute impossibility of increasing the growth of the cereal crops by mineral manures in the absence of available nitrogen in the soil; and it is tolerably well established that the nitrogen must be in the form of nitric acid. When, therefore, we use a salt of ammonia as a manure it requires to go through the process of nitrification in the soil before it is taken up by plants. Nitrogen as nitric acid being so valuable a substance as a manure for our corn crops, its economic application depends very much upon the price we pay for it and the amount of produce which can be obtained by its use. As the weights of the salts of ammonia and nitrate of soda used in these experiments are not those generally used in purchasing them in the market, it will make the matter more clear if the quantities used and the increase of crop obtained are calculated upon a basis of 112 lbs.

The increase of wheat by means of the mineral and ammonia salts over the mineral manures alone was 13·8 bushels, which was obtained by means of 200 lbs. of salts of ammonia, yielding 50 lbs. of ammonia. One cwt. of sulphate of ammonia yielding 27 lbs. of ammonia would have increased the crop by 7½ bushels. Using the same mode of calculation for nitrate of soda, we find that 1 cwt. would give an increase of 6 bushels. With barley we find that 1 cwt. of sulphate of ammonia gives an increase of 10½ bushels, while the same quantity of nitrate of soda gives an increase of 9 bushels. If these results could be obtained in ordinary practice a very considerable profit would be made. In

regard to the application of nitrate of soda to barley, the increase would at the present time be obtained at a cost of not much more than one shilling per bushel.

That such an amount of increase is not obtained in ordinary farming is quite evident. This may be traced chiefly to two causes; first, to faulty application, the salts not being evenly distributed over the land; secondly (and this is, perhaps, the most important), to the amount of weeds in the land. Weeds feed greedily on nitric acid, robbing the corn of the food it would otherwise take up. It is true the nitric acid is not absolutely lost, as the ploughing down the weeds, and their eventual destruction under the soil, again furnishes nitric acid at some future time; but the immediate effect is to render it necessary to use a larger amount of nitric acid to do the same amount of work.

Although the results obtained in Stackyard Field are much higher than can be obtained in ordinary practice, owing to the absolute freedom from weeds and the careful distribution of the manures, still there is a considerable difference between the amount of nitrogen applied in the manure and that which is taken up in the crop. If we take the mineral and nitrate manured barley, which shows an increase of more than 3,000 lbs. in corn and straw per acre over the mineral manured plot, it is probable that not more than two-thirds of the nitrogen applied in the manure are to be found in the crop; and it is almost certain that in the ordinary practice of agriculture much less than one-half the nitrogen in the ammonia salts or nitrate of soda would be found in the crop to which it is applied.

The experiments in Stackyard Field throw some light upon the destination of some portion of this residue. For the last five years a portion of the wheat and barley which has received minerals and ammonia, or minerals and nitrate, one year, received the minerals alone the next year. On the wheat land, the minerals which followed the minerals and nitrate of the previous year show no increase of crop over the land which is always under mineral manures. Where salts of ammonia are used there is a gain of 2¾ bushels of grain per acre, but no gain in the straw. On the barley, the gain by the minerals where the nitrate was applied the previous year is 11 bushels and 2¾ cwt. of straw, while the gain from the previous application of salts of ammonia is nearly 14 bushels per acre and nearly 8 cwt. of straw.

All this is very interesting, and tells us that we must not be in too great a hurry to say that ammonia and nitrates are all exhausted by the first crop of corn to which they are applied. Here we have a very light soil, without vegetation from August in one year to the spring of the following year, holding a suffi-

cient amount of a soluble salt to produce 11 and 14 bushels of barley per acre. How much more may exist in the soil to be available for other crops having longer lives and a more powerful arrangement of roots it is impossible to say. It is, however, evident that the subject is one of great interest, bearing as it does upon the value of unexhausted manures, &c., and must be one of many others which science has to take in hand.

In a lecture on root crops recently delivered by Dr. Gilbert at Cirencester, he pointed out that the use of nitrogenous manures was to increase the non-nitrogenous substances in our crops. He showed that in the field at Rothamsted which has long been under root crops, we obtained about 20 lbs. increase of sugar in our mangolds, for each pound of nitrogen which we applied in manure. In cereal grain, starch is found in the seed, and not sugar, but it is quite possible that a similar calculation would show that the increase of starch obtained by the application of one pound of nitrogen would not differ very much from that of the sugar in the mangolds.

The very large increase in the wheat, and the still larger increase in the barley, by means of salts of ammonia and nitrate of soda alone, show how large must be the amount of mineral substances existing in the soil. We must not, however, infer from this that these crops remove the same amount of potash or phosphoric acid which is carried off by plants under ordinary circumstances. In some respects plants resemble man and animals: where food is abundant they take of the best, and sometimes more than they can make use of; where it is scarce or of inferior quality they do the best they can with it. In some of our barley experiments, where nitrogen, phosphoric acid and potash, and the same amount of nitrogen and phosphoric acid without potash, have been applied for a number of years, the crop has been nearly the same in both instances; but while the straw in one case contained 48 lbs. of potash, in the other it contained less than 7 lbs. Were it not for the economy of the plant, our soils, when constantly cropped without a sufficient supply of important manure ingredients, would be much sooner exhausted.

Although the large increase in wheat and barley obtained in the Woburn experiments by the application of salts of ammonia and nitrate of soda cannot be obtained in the ordinary practice of farming, still it is quite certain that, by more careful attention to the various circumstances necessary to insure success, a much larger yield of crop from a given quantity of manure is quite possible. Now that we have in several counties important experiments carried out under the superintendence of practical farmers, we may expect a much more rapid diffusion of know-

ledge in regard to the action of manures and cattle foods; and the connection between elaborate experiments carried out with everything necessary to insure accuracy and the careful but more practical experiments in the different counties will be found very close.

This short summary of the ten years' careful experiments in Stackyard Field cannot fail to add greatly to the knowledge of the value of manures, and to be a useful guide to those who are studying science in connection with practical agriculture.

II.—*On the Conditions of Wheat-Growing in India.* By George Watt, M.D., F.L.S., C.I.E., Reporter on Economic Products to the Government of India.

The history of the foreign trade in Indian wheat is obscured by numerous conflicting theories and opinions which greatly disfigure the literature of the subject. In the writer's opinion the public mind has been diverted from the salient features of the industry. It is of little consequence whether the depreciation in the value of silver acts favourably or unfavourably, unless it can be shown that the existence of the wheat trade is vitally dependent on the fluctuations of the silver market. Many causes have doubtless combined to assist in the establishment of the present remarkable trade. The question at issue may be stated briefly thus: *Is the trade a good and natural one? Has it reached its maximum development?* The former will have to be answered, among other considerations, by an enquiry in India as to whether it is profitable to the cultivator, and in Europe as to whether it is meeting a demand which, another country in the future may more successfully contest. The latter can alone be solved by a somewhat detailed analysis of the sources of food-supply of the people of India taken in the light of the increasing population, the possible extension of agricultural operations, and the profitable establishment of new branches of industry or the enhancement of indigenous handicrafts. These are problems of political economy which have to be studied in every country, whether Eastern or Western. They represent the adjustment between the productiveness of soil and man's inventive resources.

With India, as with the United States of America, vast tracts at rich land have given a preponderance to agriculture and agricultural questions which in the past (at least of India) may be said to have eclipsed all other considerations. But that a radical change is destined to be effected in the not very distant future of India, we have a foretaste in the successful manner in

which the Bengal jute-mills have competed with Dundee, and in the keen spirit of rivalry with which the Bombay cotton-mills are disputing with Manchester in the Asiatic markets. Far more will depend in the future on the growth of our cotton, jute, woollen, paper, and other mills, than on the demands of Europe for Indian wheat. Thoughtful men in India are beginning to speak in an undertone of India's agricultural prosperity as her greatest source of weakness. But it is an open question whether Europe would suffer most under the importation of a large surplus of cheap agricultural produce, or in having the Indian market closed to European goods through the growth of local industries.

Were it necessary, a number of illustrations could be given to demonstrate the existence of a considerable wheat-cultivation in India one hundred years ago; and were it desired to carry the evidences of an Indian wheat-cultivation into even earlier periods, it might be remarked that by following the line of reasoning adopted by M. de Candolle in his "Origin of Cultivated Plants," the existence of Sanskrit names both for the grain and the plant might be cited in proof of an Indian cultivation perhaps reaching to the remotest antiquity. While not desiring to throw doubt on the importance often attached to a classical name, we in India are frequently brought face to face with striking modern adaptations of ancient names. There can be no doubt, however, but that wheat has been cultivated for many centuries in certain provinces of India, if not as a staple crop, at least as one of some importance, though there is not much evidence to show that a very extensive system of selection of seed has been practised.

The study both of wheat and of rice will be found to lead to the startling conclusion, that almost from time immemorial the owners of a certain holding—father to son—have gone on cultivating from the same stock. This explains the presence, within a comparatively limited area and on almost identical soils, of a large number of forms of both cereals. Indeed, the differentiation is sometimes carried to a fanciful extent—the farmer having continued to preserve peculiar races of wheat, rice, or pulse, as mysteriously suitable to certain fields in his holding. Rotation of crops even in the present day is not much understood, although the exhausting nature of certain crops is fully appreciated. What rotation does exist consists mainly in sowing the crop that requires the richest soil, after heavy manuring, and then following for several years, without the addition of any more manure, a rotation of crops in a descending scale of requirements. In the list of crops so cultivated, it is a frequent occurrence to find two or three forms of wheat or of

rice, as the case may be, raised to the important position assigned by the European farmer as elements in the rotation. That there exists a wide range in the races of Indian wheat is well known; and this may be relied on as a substantial evidence of an ancient cultivation.

Influences of a perfectly natural character have, during the past twenty-one years, been operating favourably to the wheat trade—have, in fact, been developing every branch of India's foreign commerce. Some of the more important of these may be here exhibited.

The Area of the Indian Empire extends to 1,382,624 square miles. This embraces hills and plains which possess the climates and soils of the world. The portion known as British India has an area of 868,314 square miles. The area of Russia in Europe exceeds that of India by about 700,000 square miles.

The Population of India is rapidly increasing. The last census gave the total for all India as 253 millions. Russia in Europe stands at 88 millions, or considerably less than half the population of British India.

The Density of Population to the square mile for India collectively is 184 persons, for Russia 40. The mass of the people is, however, crowded into the Gangetic basin.

Taking one province of British India by way of illustration—the North-West—this has a population of forty-four millions. It possesses a density of 403, or, approximately, twice as many human beings to every square mile as occur in the German empire, three times as many as in France, four times as many as in Scotland, five times as many as in Spain, and twelve times as many as in Russia.

The Agricultural Area of India.—About 600 million acres of British India have been more or less surveyed—that is, considerably less than half the area of geographical India. The returns published do not embrace the whole surveyed region, but there are certain facts shown that are of vital importance. From 150 to 199 million acres are cultivated, including a mean of twenty million acres of *normal* fallow land. The actual area of cultivation fluctuates from year to year according to necessity. Close upon 100 million acres are returned as land available for cultivation, and about the same amount as land not available for cultivation, including 38 million acres under forest.

The table opposite shows in a summary form all the more important agricultural statistics of British India.

In spite of its "teeming millions" and its rapidly increasing population, little more than two-thirds of the surveyed cultivable portion of India have as yet been ploughed. If to this we add the fallow lands which a more scientific agriculture would perhaps bring under crops, and if we take into consideration

ABSTRACT OF THE MORE IMPORTANT AGRICULTURAL STATISTICS OF BRITISH INDIA FROM THE RETURNS FOR 1885–86.

[*With the exception of Bengal and Ajmere, for which statistics are not available.*]

	References	Madras	Bombay	North-Western Provinces	Oudh	Panjáb	Central Provinces	Assam	Lower Burma	Coorg	Berar
Total area as shown by the Survey of 1885–86		acres 90,996,710	acres 71,369,639	acres 56,170,388	acres 15,312,000	acres 74,031,360	acres 74,199,040	acres 28,640,357	acres 55,820,902	acres 1,013,000	acres 11,337,115
Area the details of which have been worked out	A	58,106,157	52,183,254	43,815,270	15,307,804	68,649,600	41,685,314	13,121,946	55,820,902	1,013,000	11,337,115
Area under cultivation	B	27,480,906	32,190,352	27,131,379	9,252,756	25,209,693	14,570,362	1,807,206	4,476,847	162,424	7,509,624
Actually cropped	B = { C	22,463,253	25,424,532	25,102,975	8,819,063	20,512,118	13,466,675	1,596,366	4,200,829	138,345	6,558,379
Current fallows	D	5,017,653	6,765,820	2,028,404	433,693	4,697,575	1,103,687	210,840	276,018	24,079	951,245
Total area uncultivated	E	23,013,771	13,959,879	14,834,664	5,700,820	32,938,393	14,272,055	9,683,002	48,752,835	697,557	3,151,272
Land available for cultivation .	E = { F	8,052,375	6,389,034	8,174,479	3,396,580	20,641,801	7,705,263	—	23,659,787	48,350	790,474
Land not available for cultivation	G	12,339,878	7,570,845	6,660,185	2,304,240	12,296,592	6,566,792	—	25,093,048	649,207	2,360,798
Land not determined whether F or G	H	2,621,518	—	—	—	—	—	9,683,002	—	—	—
Forests	I	7,611,480	6,033,023	1,893,549	566,170	5,707,849	12,842,897	1,631,738	2,591,220	153,019	676,219
	—	A = B + E + I	A = B + F + G + I	A = B + E + G + I	A = B + F + G + I	A = B + F + G + I	A = B + F + G + I	A = B + H + I	A = B + F + G + I	A = B + F + G + I	A = B + F + G + I
Total area of crops cultivated . .	J	24,082,628	26,100,905	29,159,073	11,025,802	22,613,077	14,165,286	1,763,490	4,207,460	138,892	6,558,379
Deduct area more than once cropped	K	1,619,375	676,373	4,056,098	2,206,739	2,100,959	698,611	167,124	6,631	547	scarcely any
Actual area on which crops were grown	C	22,463,253	25,424,532	25,102,975	8,819,063	20,512,118	13,466,675	1,596,366	4,200,829	138,345	6,558,379
Area under the chief crops (omitting minor crops, *e.g.*, indigo, jute, tea, coffee, sugar-cane, tobacco, &c.)											
Rice	. .	5,795,644	1,950,527	3,934,521	2,159,425	597,002	3,170,360	1,128,893	3,704,990	73,805	25,832
Wheat	. .	30,275	2,290,243	4,015,897	1,556,198	7,248,216	3,858,809	10	—	—	808,515
Other food-stuffs	. .	13,862,139	17,000,851	16,100,686	6,013,995	11,489,263	4,387,060	54,761	42,617	1,568	2,842,892
Oil-seeds	. .	1,364,093	2,013,527	677,450	314,934	759,013	1,705,017	163,353	28,251	—	939,082
Cotton	. .	1,358,260	2,215,922	1,587,346	72,030	1,035,614	613,258	1,732	8,400	—	1,846,470

errors in the estimation of cultivable and non-cultivable lands which necessity alone will definitely determine, it may safely be concluded that little more than half the agricultural resources, even of British India, have as yet been tapped.

Modern Improvements and Facilities brought about through European enterprise have greatly assisted the inherent capabilities of India. Among these the opening of direct telegraphic communication between India and England in 1865 must take a prominent place. The commerce of Her Majesty's Eastern Empire was thereby brought into touch with the "mother country." It was rendered possible to interchange a knowledge of the state of markets at the same moment. As a consequence, a large business like that of cotton, and even a business like that of wheat, which must ever be more or less speculative, became possible. Of no less importance was the *opening of the Suez Canal* in 1869. The time necessary to deliver Indian produce in the European markets was materially lessened, viz. from three or four months to four or five weeks; and in the case of wheat the risk from weevil was greatly mitigated.

Within India itself greatly enhanced *facilities of transport* were instituted. Roads were pushed over the country in every direction, river communication simplified, and harbour accommodation greatly improved. The opening of Prince's Dock, Bombay, enabled the shippers from that port to carry on their business throughout the year, whereas formerly the monsoons practically stopped the export trade for three months of the year. As a forecast it may be added that the docks at present under construction in Calcutta will have a similar effect.

Railways were introduced and pushed on at the following rate of construction:—

In 1853 there were in all	$20\frac{1}{2}$ miles
„ 1863 „ „	2,519 „
„ 1873 „ „	5,695 „
„ 1883 „ „	10,317 „
„ 1887 „ „	13,386 „

and at the present moment 14,510 miles are open to traffic. The railway between Calcutta and Bombay was opened in 1870. Very shortly a second route will connect the eastern with the western capital of India, and open up at the same time one of the richest wheat-producing tracts of the country. Dr. Forbes Watson, in his memorable report (1879) on the wheat trade of India, pointed out that the opening of the Indus Valley Railway would lessen the distance between the Panjáb wheat-fields and a port of shipment by a mean of 400 miles. The prophecy contained in the following sentence has been literally fulfilled, although at the time, both in official and private circles, it

was viewed as the sanguine expectation of an enthusiast. Dr. Watson wrote:—

"The completion of the Indus Valley Railway is thus calculated to bring about a complete revolution in the wheat trade of India, which is likely to assume in the Panjáb a magnitude considerably greater than that it is likely to attain in the districts from which the wheat is at present exported."

Greater facilities of transport within the Panjáb are even now being projected, so that the possible magnitude to which the Panjáb wheat trade may attain need by no means be viewed as established. The beneficial effects of a greatly extended railway system than India even now possesses cannot be over-estimated.

But it is impossible to conclude this brief account of the improvements which have already been effected and are still further being carried out in India without reminding the reader of the *Irrigation Works.* By the aid of canals, and to a still greater degree by means of wells, immense tracts of country have been brought under crops which were formerly almost non-productive. By a system of Government aid the soil of India, wherever water can be reached, is being penetrated by wells. But of the total cultivated land only some thirty million acres up to date are artificially irrigated. Of course immense tracts of India require little or no aid in this direction. The periodicity of the rains and the accompanying inundations fully provide for the wants of the cultivator in such regions; and there are soils in India so retentive of moisture that they remain permanently fruitful without requiring either to be inundated or artificially irrigated. Of the thirty million acres artificially irrigated, perhaps not more than five million derive their supplies of water from canals. The great Ganges Canal, which irrigates the Doab (that is, an interfluvial tract) between the Ganges and the Jumna, was opened in 1854. The main stream from which the arteries of supply spread over the Doab is 525 miles in length.

But there are other considerations which, while of minor importance compared to the latent resources of the country, are still deserving of notice. There are soils and climates in India, if not in one district, at least in another, that are suitable for the cultivation of any known crop. Within her own territory India can thus produce all the requirements of modern trade. Interprovincial exchange, through the conveniences now afforded by road, rail, and river, can meet the wants of the people, and afford over and above a large surplus of any desired commodity for export. The agricultural holdings are small: the capital invested in plant absolutely insignificant. It is thus possible for the cultivator to turn the fields which he has devoted to

foreign trade into cotton, wheat, or any other article that may be called for. As to wheat, he has this advantage, that his crop comes into the European markets when prices are ruling high.

All the facts go to prove that the wheat trade up to its present stage is a perfectly natural one. The people are exporting only what they specially cultivate for that purpose. So long as wheat is a remunerative crop they will continue to cultivate it. The moment better profits can be realised on another crop they will turn from wheat, without being in the smallest degree incommoded, just as they assumed and again resigned a greatly extended cotton-cultivation. It must be admitted, however, that there *is* a fixed limit to the cultivation of Indian wheat. That limit has yet to be clearly defined; but it rests in the degree to which minor crops can be advantageously replaced by wheat. When that point has been finally reached, extension can alone take place in either of two directions—the displacement of such important crops as oil-seeds and cotton, if wheat should prove more remunerative, or the extension of the agricultural areas.

That new land would for some time be unsuited to wheat goes without saying; but there is abundant evidence that the agricultural area is being extended. The millets and other inferior crops will doubtless be at first cultivated on new land, but the history of the Panjáb wheat-cultivation proves that it does not take long before new lands can be advantageously thrown under wheat. A difficulty exists in the opposition which the native usually shows to migrating far from the neighbourhood of the hut which he calls "home." That this difficulty is being largely overcome we have notable examples in the way in which Burma is being peopled, and in the colonies of coolies who are year by year settling in Assam after the expiration of their tea-garden contracts. Indeed, the whole history of tea-cultivation points to a new direction in which agricultural progress might be effected. If left to themselves, the natives of India would never have thought for a moment of tea as a profitable enterprise, or of Assam as a favourable region to migrate to; the valley of Assam would not have been in its present prosperous condition but for European enterprise in tea-cultivation. Were it possible to offer to European capitalists large tracts of land to be held for considerable periods, the homesteads of the European farmer or *zemindar* would soon form the centres around which new populations would accumulate. More in a few years might in this way be effected in the agricultural reform of India than seems likely to be accomplished by a century of Government experimental farms.

Having briefly touched upon some of the larger general questions of the Indian wheat trade, we may turn to matters of a more specific character, by endeavouring to deal with some of the leading features of wheat-cultivation as practised in the various provinces of India. In doing so we shall follow a more or less geographical sequence. Commencing in the extreme north we shall discuss the Panjáb wheat, then that of Sind, of Central India, of Bombay, of the Central Provinces, of the North-West Provinces, of Berar, of Hyderabad, of Mysore, of Madras, and conclude our account with Bengal, Assam, and Burma. The systems of cultivation pursued, the nature of the soils, and the facilities of transport, are so dissimilar that it becomes impossible to speak of India collectively. So far as the space at disposal will admit of, we shall present a brief abstract of the main features of the wheat of each province.

Climatic Peculiarities.—A line drawn from about Bombay to Patna would approximately divide India into its two primary agricultural areas. The North-Western half, isolated by the line indicated, has during the autumn, winter, and part of the spring months a climate like that of Northern Europe; and during summer, a dry tropical climate. The extremes of dry heat and sharp cold which it experiences give to this division a rich, temperate, annual vegetation during two-thirds of the year, but preclude the growth of luxuriant arborescent jungles, since few trees or bushes can endure the extremes of climate. During the summer large expanses of this region appear, therefore, like deserts. Indeed, so deficient is the rainfall in immense portions of the Panjáb, for example, that while they possess rich fertile soils, they are uncultivated from want of water.

The South-Eastern division, on the other hand, has a more or less tropical climate all the year round, and, particularly in the more eastern section, is remarkably humid. The Northern division has, in fact, a stunted vegetation, more like that of Europe, and possesses graceful herbs, with small flowers; while the Southern has an overgrown appearance, with large flowers. These types are preserved in both regions, even when, by ascending into higher altitudes, temperate or even Arctic climates are reached.

But there are two other considerations which have to be placed before the reader, in order to complete this picture of the climatic peculiarities of India. The sea influence gives a modification, which may be said to carry the South-Eastern type from Madras round Cape Comorin, and up the Western Gháts, to Bombay. A belt of land from the sea-shore along this line possesses the warm moist features of the Eastern division of India; but, passing inland, the great tableland of India is

reached, which may be said to be demarcated by the Nerbudda, the Jumna, and the Ganges Rivers. This has a mean altitude of between 1,000 and 2,500 feet, with isolated peaks rising to 6,000 feet above the sea. The influences of this immense table-land are very considerable. We shall, while speaking of the wheat of the Central Provinces, have occasion to allude to some of these; but, meantime, it may be here stated that through altitude the winter temperate region of India is carried by isolated patches of country considerably to the south of the line indicated, Hyderabad, Bangalore, and Mysore possessing a more or less temperate winter.

Inundation.—Speaking of the two most valuable cereal crops of India, we have in the above geographical sketch established the regions of their cultivation. The tracts of India which have a temperate winter are, or may be thrown, under wheat, while the remainder corresponds to the rice area. The region of rice-cultivation is also that of greatest rainfall and of annual inundation. It would be beside our present purpose to branch off at this point into a dissertation on the subject of annual inundations, and of the degree of fertilisation thereby caused. Suffice it to say that in Lower India the degree to which the waters from the rivers are poured over the plains is infinitely small as compared with the inundation due solely and simply to rainfall.

The rivers of Lower India are carried within elevated beds across the plains, and, practically speaking, may be said to neither irrigate nor drain them. These elevated beds have sloping banks, perhaps of miles in extent, which the rivers on rising unquestionably inundate and fertilise; but were the main stream of any of the rivers to find a passage through its self-constructed channel, it would at once plough for itself a new course, and leave its old bed as a serpentine lake. It is needless to mention cases in which this has actually occurred. Bridges span the dry channels of former rivers, and even mighty streams like the Brahmaputra have changed their courses. These are, however, comparatively rare occurrences, and, passing across the elevated bed annually inundated (which, as stated, may be many miles in breath), the level of the plains is ultimately reached—a level below that of the rivers. Expanses of the latter nature derive their fertility from the rains alone. They become swamps, on which no other crop save rice can be cultivated. This is the character of the inundation of Bengal as a whole, in which no motion in the water of the fields can be traced, either from or towards the rivers. Gradually as the rain falls the fields get flooded, and the level of the water rises to a depth of two to five feet. The crops keep growing apace with this rise of the

water; if they fail to do so they are ruined. After the rain subsides, the autumn heat begins to suck up the water, and in time bakes the field, immense cracks severing it into great blocks of clay as hard as stone. Hence it follows that agricultural operations cannot be resumed until the ground is softened again by rain.

In Upper India a much greater degree of river inundation exists; the doabs, or tracts of land between two rivers, being referable to three distinct areas: (*a*) that portion which is regularly inundated by the rise of the rivers on either side; (*b*) the further portion where the waters of the rivers penetrate underground, and may be reached by wells from twenty to sixty feet deep; and (*c*) the central elevated ridge, that is entirely dependent on rain or artificial irrigation.

Area of Artificial Irrigation.—While indicating the nature of inundation, we have also briefly exemplified the regions where canal irrigation is possible and beneficial. Canals in Bengal, as a whole, would be entirely out of the question. The nature of the primary agriculture is distinctly aquatic, and the annual rainfall is sufficient to produce the required degree of inundation. In times of drought, canals could never reach more than an infinitesimal portion of the country, they would only be required once in perhaps every ten or twenty years, and might during the interval prove dangerous to the natural drainage of the country. In Upper India it is quite otherwise. There are immense tracts of country uncultivated simply because the rainfall is too small to admit of cultivation, but which could be at once thrown under wheat and other crops if artificially irrigated. Sir John and General Strachey, in their work on the "Finances and Public Works of India," prove that the value of land is immensely increased by the construction of canals, and show that the two great canals in the Panjáb "in a single year added to the wealth of the Panjáb a sum not less than two-thirds of their entire original cost."

Wheat and Rice Areas.—We have above briefly indicated the great wheat and rice areas; but where these meet and overlap, the millets become important. Where rice-cultivation diminishes, the millets appear, with more and more wheat, and less and less millets, until the great centres of wheat-production are attained. The pulses and oil-seeds are common elements of all Indian agriculture. Professor Wallace, in his recent lecture at Edinburgh, very properly pointed out that the balance of the soil in European agriculture is largely preserved through the rotation of leguminous crops with cereals. He seems to have formed, however, a too gloomy opinion as to the degree to which this fact was being lost sight of in the agri-

culture of the present day in India, mainly through the temptations offered by the modern wheat trade. The pulses and oil-seeds all require a moderate amount of rain and heat, and therefore can be grown in every province of India. They cannot endure being swamped, and therefore are cultivated during the dryer seasons in the inundated areas; they cannot stand too much cold, and are therefore grown during the intermediately warm periods in Upper India. In other words, they cannot be grown, or only to a limited extent, during the periods when rice and wheat occupy the fields. This has given origin to the two crops *rabi* and *kharif*, to be subsequently referred to.

Thus, climatic necessities force a rotation of crops on the Indian cultivator, and hence it is by no means clear that the present wheat-cultivation is destroying the beneficial results from the cultivation of leguminous crops. Gram, besides, is very largely grown along with wheat, as a mixed crop, because shaded underneath the taller crop. The millets and pulses are much more the food-crops of the people of India, as a whole, than either wheat or rice, although in Bengal rice is the staple food, and in Upper India a large amount of wheat is daily consumed. Still, the people of India must have pulses and lentils, and these they will, and must, continue to grow. If one cultivator discontinues doing so, he will have to purchase his supplies. Prices of pulses would rise, and the balance be finally obtained, when it would become more profitable for him to resume pulse-cultivation than to continue to buy. Supply and demand must of necessity check a too extensive abandonment of pea-cultivation, and as oil-seeds are more profitable even than wheat, there would appear to be no danger of injury to the soil from the cause suggested.

Crops and Seasons.—The European farmer has but one season a year during which he can cultivate his field. The Indian cultivator, at least in most districts, has two, known as *rabi* or spring harvest, and the *kharif* or autumn. The various staples grown during the former begin to be sown about the end of September, the sowings continuing till the end of December. They are reaped in two, three, four, or five months' time, viz. from December to May. The *kharif* staples, on the other hand, are sown as soon as the land can be cleared of the *rabi* crops. Some of the sowings may take place as early as February or March, and the last sowings are made about the middle of August. The *kharif* harvest occurs chiefly between the beginning of October and the end of December. The labour of the agriculturist is mainly spent

on the *rabi* crops; for these the land is elaborately ploughed, weeded, and fairly well manured. For the *kharif* crops the land is little more than scratched, and the seed sown with the first shower of rain. It is a common practice to allow *rabi* lands to remain fallow during the *kharif* season, or at most to sow on the patches nearest the homestead some of the pulses required by the cultivator. When this course is departed from, cotton or sugar-cane is grown on these lands, the latter as a rule preceding wheat. The study of the crops grown in India will reveal the fact that, unless desired to lie fallow, no portion of a fairly well watered farm of good average soil need remain long without crops. The cultivator has at his disposal hot season, rainy season, and cold season crops that take varying periods, from two to twelve months, to mature. Hence it follows that in the intervals between *rabi* and *kharif* a third crop is frequently obtainable.

In large portions of India, however, the want of water compels the farmer to be dependent on the minor crop—*kharif*—since that is sown with the advent of the rains. During that season the chief food-stuffs of the bulk of the people are grown—millets and pulses. From a commercial point of view these are less important than wheat, rice, and oil-seeds; but collectively they are more extensively grown than all the other crops. Cotton is a *kharif* crop, but it requires rich land, while the millets luxuriate on the lighter loams. A soil that yields two crops a year is known as *dofasli*, while *ekfasli* bears but one crop.

The twice cropping of the soil is the element that has introduced the apparent confusion in the returns of Indian agriculture. It has been triumphantly shown, in derision of Indian returns, that the land under crops was greater than the area of the district or province. This same fact of twice cropping the soil introduces a complexity which renders it difficult to determine with absolute certainty the exact area under certain crops.

Two different forms of rice are, for example, mixed and sown at once over the same field, or the one is sown or transplanted into the field after the other has germinated. The two grow together; but the one reaching maturity long before the other, the field is cut—a process which seems only to make the second crop sprout more thickly. Without any further labour a second crop is shortly after harvested from the same field.

In the same way two or more different crops are mixed, because of the one assisting the other to combat climatic disadvantages; and for this further reason, that should failure overtake the one, the other may yield a return. Experience has established the necessity for this with certain soils, and under peculiar climatic conditions. Loud complaints have been

heard against this practice; but in the majority of cases the native cultivator is perfectly sound in the course he pursues.

As a peculiarity of the people of India, it may be added that—whether it be the cause or the consequence of this practice of mixing grains—gram and wheat, and barley and wheat are eaten mixed, and indeed often preferred to pure grain. Where the cultivator does not grow the mixture, the retail merchant effects it; but in few cases has it been shown that the cultivator mixes for the purpose of defrauding. He is not responsible for the market to which the dealer consigns his produce. He grows a mixture because it is in requisition for a market which, after all, is infinitely more extensive than the modern foreign demand. Adulteration is undoubtedly practised—but little more can be laid to the blame of the actual producer than that sufficient attraction has not as yet been offered to induce him to adopt more expensive processes for obtaining a wheat that would be free from the dirt incident to a primitive system of thrashing, winnowing, and storing.

To convey some idea of the character of Indian agriculture, it seems desirable to furnish in this place a table showing the chief *rabi* and *kharif* crops grown in four of the wheat-producing provinces. A critical inspection of the dates of sowing and reaping will demonstrate what we have tried to establish—viz. that there are influences (over which the cultivator has little control) which preclude a greatly extended displacement of the food-stuffs of the mass of the people, either by wheat or by any other remunerative article of export trade. These same influences prescribe a certain rotation of crops every twelve months. But we shall have occasion later on to show that a more extensive rotation than this is very frequently pursued. The table opposite will establish that, with few exceptions (*e.g.* the pulse of the *rabi* season), the greatly extended cultivation of wheat would not effect the preservation of the balance of the soil, through the growth of peas and other leguminous crops in alternation with cereals. It will be seen that cotton cuts more seriously into the millet and pulse season than wheat, since that staple occupies the soil, on an average, from June to January, or even February.

Running the eye down the two columns for each province, it will at once be apparent what crops might interfere with wheat extension, and might therefore be liable to displacement. But by recalling what has been said about the nature of the soils, a safeguard will be obtained against a too literal interpretation of the effects of the dates of sowing and reaping. It does not follow that a crop which is shown by the table to occupy fields during the period of wheat-cultivation, is being

Statement showing the Seasons of Sowing and Reaping the chief Crops in the Four principal Wheat-producing Provinces of India.

	Crop	Panjáb		Bombay		Central Provinces		North-West Provinces and Oudh	
		Sown	Harvested	Sown	Harvested	Sown	Harvested	Sown	Harvested
	Wheat	10–12	4–5 R	9–11	2–4 R	10–11	3–4 R	9–10	3–5 R
Cereals	Barley	10–12	3–4 R	10–11	2–3 R	10–11	2–3 R	9–10	3–4 R
Cereals	Indian corn	6–9	9–11 K	6	8–9 K	6–7	10 K	6–7	8–9 K
Cereals	Jowar } millets	7–8	9–12 K	6 8–10	10–11 K 2–3 R	6–7	11–12 K	6–7	11–12 K
Cereals	Bajra } millets	7–8	9–11 K	6–7	9–10 K	8	10 K	7–8	10–11 K
Cereals	Rice	7–8	11 K	6	10–11 K	6	10–11 K	2–3 6	8–9 12 K
Pulses	Gram or Chicken Pea	8–10	3–4 R	9–10	2–3 R	10–11	3 R	9–10	3–5 R
Pulses	Dal or Thur	6	3 R	6–7	9–2 R	6	2–3 R	6–7	K 10–4 R
Pulses	Mung or Green Gram	8	11–12 K	5–6	8–9 K	6–7	10 K	6–7	10 K
Pulses	Urad or Black Gram	8	11–12 K	6	9 K	6–7	10 K	7–8	11–12 K
Pulses	Moth	7–8	11 K	6–7	10–11 K	7–8	11 K	7–8	11–12 K
Pulses	Shim or Poput	7–8	11 K	6–7	10–11 K	7–8	11 K	7–8	11–12 K
Pulses	Kulthi or Horse Gram	7–8	11 K	6–9	10–11 K	6–8	11 K	7–8	11–12 K
Pulses	Peas	9–10	4 R	10–11	2–3 R	9	3 R	10	2–3 R
Oil-seeds	Mustard	8–9	2–3 R	nil	nil	8	3 R	9–10	12–1 R
Oil-seeds	Rape	8–11	3–4 R	10	1–2 R	8–9	3–4 R	10–11	4–5 R
Oil-seeds	Linseed	9–10	3–4 R	11	2 R	9	3–4 R	10	4–5 R
Oil-seeds	Til (Sesamum)	7–8	11 K	6–7	9–11 K	7–8	10–11 K	6–7	10–11 K
Oil-seeds	Castor	6–11	K 11–2 R	6–10	K 11–2 R	7	12–2 R	6–7	2–3 R
Oil-seeds	Ground-nut	nil	nil	6	12	nil	nil	nil	nil
Fibres	Cotton	4–5	K 9–1 R	6–7	K 11–12–3 R	6	10 K	7 6	2 R 10 K
Fibres	Jute	Not much cultivated; has been tried in the Central Provinces.							
Fibres	Sunn-hemp	7	10–11 K	7	10	7	10 K	6	9
Dyes	Indigo	4–5	8–9	Being opened up		nil	nil	4–6	8–9 K
Dyes	Safflower	Little grown		10–11	2–3 R	Little grown		9	2–4 R
	Sugar-cane	2 3	10 K 12–2 R	1–3 6	12–2 K 5 R	1–2	12 K	2 3–4	11 K 12–3 R

Note.—The letters R and K denote *rabi* and *kharif* crops; the figures are the months of the year.

grown on a soil upon which wheat might be cultivated. The opposite argument may, however, be employed in its full force —viz. that crops that are grown in the interval of wheat-cultivation may be reared on wheat-fields. Wheat is sown in the various districts of the Panjáb from the middle of October to the end of December. We have given only the two principal millets, but the periods of sowing and reaping all the others correspond to those shown. They are off the fields just in time to admit of the wheat crop, should the cultivator have chosen to employ the *rabi* fields with a millet crop.

As a matter of fact, however, he rarely adopts this course, since the millets grow well on soils not suited for wheat. They of course can be grown, and are, by way of a rotation, frequently sown on wheat land; but in such cases the land is generally left fallow till the following *rabi* season. Then, again, of the pulses: practically only two occupy the ground during the wheat season—gram and peas. The former is, however, extensively grown as a mixed crop with wheat, and the latter is not of much importance. One other pulse only need be especially mentioned, *dál* or *thúr* (*Cajanus indicus*). This is often allowed to occupy the fields for many months. It is a large woody shrub, sown around the margins of the fields, or in rows through the wheat or cotton. It does not, therefore, interfere with wheat-cultivation. All the other pulses or leguminous crops are procumbent herbs, cultivated during the *kharif* season, and are not likely, therefore, to be seriously displaced by the extension of wheat-cultivation.

There are generally two crops of sugar-cane, the stems being planted out in January, February, or March. These occupy the ground for eleven months. Sugar-cane is, however, a very profitable crop. It is grown in all the richest soils, and receives heavy manuring. After the crop is cut the land is allowed to lie fallow for a time, until the ploughing period arrives for the *rabi* crop. Without any further manuring, wheat may be sown, and a good harvest realised. To take the full advantage of the manure, this is often followed up by a *kharif* crop, or perhaps still further by a minor *rabi* crop. But after that the field is finally left fallow for the rest of the year. It may again be put under wheat, receiving light manuring, or under sugar-cane with a heavy manure, and the rotation repeated.

It will be observed that the majority of the oil-seeds occupy the soil during a period overlapped by wheat. They are *rabi* crops, which will continue to be cultivated and to compete with wheat, according to the profits realised, or as they may be considered necessary in the rotation of crops. They are, however,

like gram and *dál*, often grown with wheat as mixed crops, being generally sown in lines or around the borders of the fields. It will be observed, however, that they ripen before the wheat, and are accordingly separately reaped. Adulteration of oil-seeds with wheat must result from gross carelessness or malpractices. Cotton is, perhaps (in the districts in which it is cultivated to any extent), the centre round which the cultivator's ideas of profit and successful husbandry gravitate. It must follow wheat or other *rabi* crops—the soil getting only a brief rest, during which time it has to be rapidly ploughed. The cotton continues on the field through the *kharif* season until it is generally too late to follow with a *rabi* crop.

The illustrations we have used apply more or less to all the four provinces shown in the table of crops and seasons. The climatic and other peculiarities of each of these provinces are indicated by the varying periods of sowing and reaping. The skill of the cultivator is in each province displayed by the manner in which he can fit together his seasonal crops; but he has many to choose from, and need have no difficulty, if desired, in throwing on the field a grain that will give a return in sixty days. A well-known rice in Bengal receives the name of the "Sixty-days Rice" from that fact. We are not dealing with Bengal at the present moment, but it may be said in passing that the remarkable manner in which the crops grown in India are adapted to climate and soil is nowhere better shown than in the immense numbers of forms of rice, each directly adapted to the peculiar climate and the soil in which it is grown. There are rices that can be cultivated on comparatively dry soils, rices that occupy the ground for more than half the year, rices that grow in the cold temperate climates, and rices that can thrive only in tropical swamps. Again, of this last-mentioned class, there are some varieties that cannot survive an inundation of more than two to five feet of water, while there are others that will continue to grow even when submerged under a depth of from ten to fifteen feet of water.

This adaptability to special necessities is the great fact by which would-be reformers of Indian agriculture find their theories discomfited. No imported wheat-seed has yet been found that was of the least use to India. The season is too short for its maturing; and, moreover, there is another peculiarity of Indian wheat-cultivation that has not been fully appreciated. Although our wheats are winter wheats, in the sense that they are sown in autumn and reaped in spring (except in the case of the wheats grown on the hills), they do not lie for months under snow, nor are, in fact, even subjected to severe frost. No sooner have the first twenty to thirty days of spring

passed, than a temperature is attained quite as great as the summer heat of other wheat-growing countries. It is this circumstance that gives to the Indian wheat its great dryness; but if not fully formed by February, the plant is killed and the grain prematurely ripened.

Having now exhibited some general principles regarding Indian agriculture as a whole, we may proceed in detail to discuss the wheat-cultivation of the several provinces.

1. The Panjáb.

In accordance with a resolution of the Government of India in 1877, a collection of the wheats of India was prepared which embraced over 1,000 samples. These were forwarded to London for the purpose of examination. Dr. Forbes Watson's report, to which allusion has been made, was the result. The Panjáb section was, however, viewed as unsatisfactory from being weevil-eaten, and it was therefore suggested that a fresh collection of Panjáb wheats should be made. Further, it was recommended that to test the adaptability of Indian wheats to the three systems of milling now in use, 350 maunds of each of the four principal varieties should be forwarded to England. These two proposals were accepted, and a fresh set of 192 samples of Panjáb wheats were forwarded to London. They were examined and valued by the same expert who furnished the information regarding the first collection, and the second report appeared in 1880. The required commercial samples were also forwarded, the result being the appearance of perhaps the most powerful report on Indian wheats which has as yet been placed in the hands of the public, viz. a commercial statement of their value and adaptability to the miller, written by Messrs. McDougall Brothers, of London. This appeared in December 1882.

The Panjáb wheats of the second consignment were, as in the first report, grouped into

(1) Soft white wheats.
(2) Hard white wheats.
(3) Soft red wheats.
(4) Hard red wheats.

Subsequent to the special report on the Panjáb wheats, the Secretary of State, in 1881, called for information to be furnished (for all India) as to the nature of the soils on which the better wheats are cultivated, as well as details of the methods of cultivation—as, for example, whether the best wheats are grown on irrigated or on manured land, also "whether the land has been long cultivated with wheat crops, and what is the average weight of crop per acre." Naturally this stimulated fresh and more

detailed investigation, the result being the appearance of first one volume and then another on "The Wheat Production and Trade in India." These volumes set forth the results of the inquiries instituted in every district of India, and placed before the public a body of facts which, while couched in the guarded phraseology incidental to Indian official correspondence, may be accepted as probably quite as accurate as the wheat reports of other countries which appear with a greater degree of assurance of accuracy.

Even in the most advanced countries it is difficult, if not impossible, to give absolute statements of areas under crops, or to procure details of internal trade. Doubt has in various quarters been expressed as to the accuracy of Indian quotations, mainly, if not entirely, from the peculiar language adopted by Indian writers. The Indian Survey Department is perhaps second to no other survey in the world. Its returns are, year by year, filling up the details of India; and it may safely be said that while certain writers have lent themselves to speculate on the character and nature of the Indian wheat trade, no report of actual facts of areas under wheat, or of the extension of agricultural operations generally, or even of estimated out-turn of crops, has been subsequently shown to have been materially incorrect.

It should not be forgotten that Government lands have to be periodically re-assessed, and for this purpose a number of officers are sent specially to the district under re-settlement, who travel from village to village and from field to field, the result being the publication of the Settlement Report, which forms the basis of the Government re-assessment. For certain tracts of the country this periodical settlement affords most valuable data for judging of agricultural progress. The productive nature of every village, and even of the several fields of each village, is carefully determined, and the decision of the Settlement Office approved by the people. It would be absurd to throw such reports aside as mere approximations. They afford the groundwork on which as accurate statements may be founded as can be shown for any other country of even half the magnitude of India.

In addition to furnishing a chapter for the general report issued by the Government of India on "The Wheat Production and Trade in India," the Panjáb Government issued in 1884 a separate publication called "Panjáb Wheat." From these works, and from the Settlement, Administrative, and Agricultural Reports, together with the subsequent special reports which, it is believed, will shortly appear as the third volume of "The Wheat Production and Trade in India," we have largely culled the information brought together in this paper.

In specially hunting up the information on the Pánjab, we have selected a few of the more important districts (in wheat supply), as set forth in the report drawn up in London on the set of specimens to which reference has been made, as well as in other reports. We have been guided in our selection by the merit of the wheats alone, and from no desire to single out the districts that might most fully bear out one of the lines of argument pursued—namely, that there are immense tracts of country which await a supply of water and means of communication to become great wheat-producing districts.

It will be necessary to go into some detail under the head of Panjáb, for so much exists in common to all the wheat-producing districts of India, that the more characteristic features may be disposed of in one place, leaving only special modifications to be commented on afterwards.

Soils.—In the Panjáb, soils may be classified, first, according to the mode in which they are irrigated; secondly, according to their composition. With slight local modifications the remarks which we here offer are applicable to the whole of the alluvial parts of India. One of these tracts of country or regions with a peculiar soil may predominate more in one province than in another; and in some instances the specific character of the soil may be modified or intensified. The main features are, on the whole, preserved. We shall establish, therefore, in this place a standard from which, in our subsequent remarks under other provinces, we shall record departures and modifications.

From the numerous mouths of the Ganges, and sweeping round the whole length of the Himálayas, at the same time isolating the great southern tableland, there extends a vast alluvial plain, which is only lost in the North-West Provinces and the Panjáb by blending into the drainage area of the Indus. From this point a similar alluvial region is continued to the mouths of the Indus, and may be said to widen until it embraces the northern division of Bombay. In the Bengal section of this vast expanse, the clay soil of the rice swamps can only be viewed as land, figuratively speaking, recently recovered from the sea; and immense portions of it are even now within tidal influence.

The bulk of Bengal is rain-inundated. Passing higher up the alluvial basin, evidences of a more ancient soil, indeed of a more ancient agriculture, are to be seen in the rich loam of Behar. This soil continues with varying degrees of fertility through the North-West Provinces to the Panjáb, and down the tributaries of the Indus to the basin of the combined stream, until it reaches the swamps of the western coast. Throughout this loam expanse there are two modifications. First, on the inundated tracts of the rivers and on depressed portions of the

country (in most cases these are but the old beds of former streams, or the silted-up lakes which were thrown off as contortions of the river, isolated by the main stream taking the more direct course through a narrow isthmus), rich clayey loam occurs which merges in its character into the heavy mud soil of Bengal. Secondly, within the regions of climatic extremes, natural growth and cultivation alike have been checked, and loam is there found to be more and more intermixed with sand, until absolute sandy deserts are attained.

Thus there exist four types of soil in the alluvial plains of India: a heavy loam, in which clay predominates (the muddy swamps of Bengal); a heavy loam, with a certain amount of sand, in which the clods remain firm (the low-lying and inundated tracts of Upper India); a light loam, in which the clods are pulverised on being let fall from the hand (the principal soil of Behar, the North-West Provinces, the Panjáb, and a certain portion of Bombay and Sind); and lastly, a poor loam with a large admixture of sand, passing into pure sand in which clods do not form at all (the soil of some parts of the North-West Provinces, of a large proportion of Central India and of Sind, with also certain parts of the Panjáb). The intimate relation of the two features of soil alluded to in the opening sentence of this paragraph has been thus exemplified. The absence of water, together with the extremes of heat and cold, have had much to say to the production of desert tracts, and annual inundations have greatly tended to preserve the heavy loams.

There are certain agricultural terms used in the Panjáb, but fairly well understood throughout India:—

Thus, land that is dependent on rain is known as *bárani*; if watered by canals it is *nahri*; *chahi* is watered by wells, and *abi* from tanks. We have already defined the word *doab* (*i.e.* the region between two rivers), and have shown the natural classification of *doab* lands, according to water-supply. The five great streams of the Indus break the Panjáb into vast interfluvial expanses or *doabs,* so that, to understand Panjáb agriculture, this feature must be fully appreciated. The tracts annually inundated by the rise of the rivers, or kept moist from being adjacent to flooded land, are known in the Panjáb as *bhet, banjar,* or *sailába,* and in other parts of India as *khadár,* but by the Hindustani-speaking population this name is even used in the Panjáb. The chief danger such regions are subjected to is the growth of the saline efflorescence known as *reh* (a crude sulphate or carbonate of soda).

Land beyond the *bhet* influence is generally known as *desya* in the Panjáb, and to Hindustani-speaking people as *bángar*. This may be *chahi, abi, nahri,* or *baráni,* according to the source from which it derives its water. The interior or higher portions of the *doab* are often spoken of as *des-utar,* (in contradistinction to *hetár*) or *máhjah.*

The names given to denominate the physical character of the soil are:—

1. *Nyái,* rich land around the homestead, on which vegetables, tobacco, poppies, &c., are grown.

2. *Dákar* or *chamb*, heavy clayey loam, too low for being drained. This is good for rice and grain. The term *rákar* in the Panjáb denominates bad *dákar*, on which rice only can be grown.

3. *Rausli* or *dosahi* (*dusháhi*) is the light easily pulverised loam which we have spoken of as the most prevalent in Upper India. This yields all crops except rice. It is soft and easily worked, mixes readily with manure, and consists of clay and sand. It is probable that the term *dosahi* denotes a slightly inferior quality of *rausli* with more sand; just as *rohi* would appear to be a rich soil approaching to *dákar*, only well drained. *Rohi* is admittedly the finest form of soil in the Panjáb.

4. *Bhúr* or *maira* is light sandy loam, suitable for the cultivation of millets. In this soil the sand predominates over the clay, and *tiba* is almost pure sand, *reti* being a soil with wind-blown hillocks of sand.

Other terms are used in the hill tracts of the Panjab, and nearly every province has special terms for local modifications of the soils we have indicated. As such names can be of little interest to persons not residing in India, we shall accept the above as conveying a general description of the characteristic soils of the alluvial basin of India. A separate account will be found under the Central Provinces of the soil, terrestrial character, and peculiarities of the southern tableland. From what has been said, a general idea, it is hoped, has been conveyed of the character and fruitfulness of the soils of the plains of India. The absence of a water-supply will, of course, make the best *rausli* land entirely dependent on the rains, and the inequality and insufficiency of the rains of the Panjáb leave neighbouring tracts either uncultivated or at most only occasionally thrown under crops. This is the field for the future operations of the canal engineer. A judicious control over the supply of canal water has made these arteries carry life and fertility where formerly rich undulations of fertile soil bore only a scanty herbage. Where artificial aid, in the form of canals, is not brought to the cultivator, it will be seen, from the account of soils, that there are narrow limits within which displacement of crops can be practised.

The climate prescribes a limit to the *rabi* as to the *kharif* crop. The varied nature of the soils is such that a second check is given to the dangerous disturbance of established and natural conditions of agriculture through any greed the cultivator might manifest in desiring to reach a hand forward to the hard cash offered by an export trade like that of wheat. The extent to which the owner of a *desya* or *bángar* farm can supplant millets with wheat must depend on a chapter of accidents: the abundance of water in his wells (even should he possess such), the rainfall, the proximity of his fields to the irrigation canals, the character of the soil on which his labours from year to year have been expended. Should his fields fall under the class we have defined a *bhúr*, then, without manuring to an extent which

would never pay, he must rest content with his millet and pulse crops, for in such soils, in the majority of cases, wheat-cultivation is a physical impossibility.

While wheat-cultivation cannot, therefore, expand into the *bángar-bhúr* lands, there are immense tracts of *rausli* which wait only for means of export or for a supply of water to be at once thrown under the finest varieties of wheat.

Methods of Wheat-Cultivation in the Panjáb.—The wheat crop of the Panjáb is sown on *rausli* and *rohi* lands, and sometimes also on *dákar*. It occupies the soil for about six months—the first sowings commencing about the middle of October, and the harvest operations throughout the province being completed by the middle of March. The systems pursued vary to some extent in the various districts [1] of the province, but mainly in consequence of the nature of soil and source of water-supply. We shall, therefore, comment specially on the systems adopted in Delhi, Ambala, Jullundur, Lahore, Jhang, Montgomery, Dera-Ismail-Khan, and Dera-Ghazi-Khan.

The system followed in Montgomery for well-irrigated lands has been described thus:—

"During the rains in June or July the land is ploughed two or three times and smoothed. If rain has been plentiful and the ground remains moist, seed is sown broadcast in October, November, and December. The ground is then again ploughed and smoothed, and the beds formed. If there is subsequent rain, the fields are irrigated from wells or *jhálars* six or seven times; if there is no rain, nine or ten times. If there is little or no rain during the rainy season, or if the land does not remain moist up to October, it is irrigated before the seed is sown. If the seed is sown in October, a good crop is the result; if in November, about twenty-five per cent. less than if sown in October; and if sown in December, about thirty per cent. less."

"On *bhet* or *sailába* lands.—At the last inundation during the rains (generally in August) the land is ploughed two or three times and smoothed. In October seed is sown through a drill; no beds are formed, and no subsequent irrigation takes place, as the crop depends on rainfall."

In the majority of the districts, sowing through a tube attached to the handle of the plough is followed in preference to broadcast-sowings—the crop appearing in consequence in drills. In the Panjáb generally drill-sowing is always

[1] As the specific Indian meaning of the word "district" may not be understood, it is perhaps well to explain that it is practically synonymous with county or shire. Britih India is primarily divided into provinces; those under a governor (called presidency), *e.g.* Madras and Bombay—a lieutenant-governor (called province), *e.g.* Bengal, North-West Provinces, and the Panjáb—or a chief commissioner, *e.g.* Central Provinces, Burma, and Assam. Under each of these chief administrators, the country is next divided into "divisions," each under a commissioner, and these are again subdivided into "districts," the lowest administrative unit—each under a magistrate-collector. The ordinary district in point of area is as large, if not larger, than the average county or shire, and its climate, soil, and physical configuration quite as diversified.

practised where the character of the soil will permit of this system. In the sandy soils of Marwat the seed is drilled three or four inches into the ground without any preliminary ploughing.

Manuring is practised if the cultivator can afford to do so, but chiefly only on well-watered lands. Canal-irrigated fields are nearly always cultivated without manure. *Dákar* or *dar* lands are considered rich enough to produce wheat without any manure. The degree of watering is indicated in the following paragraph regarding the Lahore district:—

"In October the field is irrigated and ploughed twice, the grain being dropped in at the last ploughing through a tube attached to the handle of the plough. The land is then smoothed by a rough roller called *sohaga.* After this the crop is irrigated once a month for three months, and periodically weeded, if the cultivator can afford this; manure is rarely used, never at any distance from the villages. The people say there is something special in the soil, that when good seed is obtained it yields a good crop the first, and perhaps the second year, but afterwards deteriorates."

This same opinion, that without manure or a rotation ot crops the soil deteriorates if wheat be continuously reared on it, prevails over the greater part of India. In Jullundur the ploughing is begun much earlier than we have indicated—the first ploughing taking place in January or February.

With reference to enquiry as to the period land has been under wheat-cultivation in the Panjáb, instructive replies have been received.

"Wheat is considered the strongest crop, and to maintain the productive power of the land it is necessary to change this crop for some other, such as *jowar* (the larger millet), wheat being sown the second year."

"Carefully manured land can remain for five or six years under wheat."

The report on Rohtak states that "the lands now growing wheat have been so used for a long time."

Of Jullundur the District Officer writes, "There is no reason to suppose that the land has deteriorated from over-cropping. Except in highly manured lands, wheat is grown year after year."

As to deterioration of soil the opinions recorded are decidedly opposed to this. But one officer writes, "it is unquestionable that the finest crops are raised on lands newly brought under canal irrigation."

About one third of the whole cultivated area of the Panjáb is cropped with wheat. "The acreage represented by this fraction is liable to considerable variation, due mainly to the character of the seasons, and the gradual increase of cultivation in general." When this official statement is considered in the light of the available crops, it becomes apparent that fallow is necessary and understood, and that the people are well aware of the advantages of a change of crops. When these facts are

duly considered, can any doubt exist that the expansion of the wheat-cultivation of the Panjáb is not endangering in any way the fruitfulness of the soil? Two thirds of the annual cultivation consists of other than wheat crops, manuring is regularly resorted to when found necessary, and at least a seasonal if not an annual rotation is regularly observed.[1]

Reaping, Thrashing, Winnowing.—Reaping begins about the end of April, and the whole crop is in-gathered by the end of May or the beginning of June. The practice described in connection with the Montgomery district is fairly representative, though it must be recollected that the Panjáb is larger than Great Britain, and that it would be as correct to say that the wheat of Essex was characteristic of the British Isles as to say that Montgomery absolutely represented the Panjáb.

The reapers are called *láwa,* and belong chiefly to the class of village servants. But they do not confine themselves to their own village, they go wherever they can find work. The usual pay is one *pái* (seven seers) of grain, or four annas in cash per diem, with five sheaves. [This might be expressed as sixpence a day and the sheaves.] An ordinary reaper will cut down one *kanál* and a half in the day; and a strong and practised hand will do as much as two *kanáls.* (The *kanál* is half a rood.) On an average five men will cut down an acre a day. Reaping is carried on during the moonlight nights in the last few hours before day if the straw is very dry, as the moisture of the night air is supposed to strengthen the stalk and prevent the ears falling off. If clouds gather, great efforts are made to get in the crops, as hail is much feared at this season; but hail is very uncommon in this district. As soon as the grain is cut it is stacked. The reaper gets his share when the crop has been thrashed and divided.

There are several ways of thrashing. The most common is to yoke a number of bullocks together, fasten the one at the left hand of the line to a post, round which the straw to be thrashed is piled, and drive them round and round from right to left. Wheat and barley are, however, first thrashed with the *phalha,* or thrashing-frame.

A pair of bullocks are yoked to the *phalha* and driven round the stake about which the straw is heaped; there may be several *phalhas* at work one after the other, but there are never more than four. One man is required with each, and a couple more to throw back the straw into the heap. One pair of bullocks with the *phalha* will thrash the produce of a quarter of an acre a day. They will work eight hours at a stretch, from 8 A.M. to 4 P.M. in the sun. Buffaloes are never used for thrashing. When wheat or barley has been thrashed with the *phalha,* the straw is shaken up with the pitchfork and thrown on one side, while the grain falls to the bottom.

In the Bannu district cows and even donkeys are used on the thrashing-floor. In Miánwáli thrashing is frequently done by

[1] A very different state of affairs exists in Burma (indeed, almost in Bengal), where three fourths of the cultivation consists year after year of rice, with practically no rotation; but, still, this state of affairs is not attended with indications of deterioration of soil.

bullocks drawing a weighted branch of some thorny tree over the outspread stalks. The floors are generally prepared by being well beaten, and on the hills are carefully paved, the circular thrashing-floor near each Himálayan homestead forming a striking feature of the scenery. In spite of every care, the dirt from the floor is pressed into the grain, and, moreover, the grains are often seriously injured.

Winnowing, as also the thrashing, is favoured by the hot winds which prevail. The grain is separated from the chaff by being thrown up by pitchforks, and by being allowed to fall from a sieve held overhead. The chaff is blown to a distance, and the grain falls into the thrashing-floor. This labour is frequently repeated, until the desired degree of cleansing has been obtained.

Storing of Wheat and other Cereals.—The grain is stored in a large jar-like vessel made of mud, and known as the *kalotis*, or it is deposited on prepared platforms in the open, each heap carefully covered over and surrounded by a trench and hedge. If it is desired to store the grain for any length of time, it is mixed with the ashes of cow-dung, which are supposed to possess a special virtue in protecting the grain from weevil.

With the limited space at our disposal, it is impossible to deal in detail with every feature of the wheat-cultivation of each province of India. The questions of expense of cultivation, yield, and profit are points regarding which it has not been found possible to collect very trustworthy data. The people are too ignorant to appreciate the good intentions of a Government that looks too closely into matters of that kind. Fears of the old system of taxation which prevailed during Native rule have not as yet given place to the conception of the enlightened interest in their welfare taken by the present administration. The average return is probably not more than $5\frac{1}{2}$ maunds an acre from unmanured rain lands, $7\frac{1}{2}$ maunds from manured, and 10 ($13\frac{1}{2}$ bushels) to 14 maunds from land manured and irrigated (*see* Central Provinces). The principal wheat cultivated is the soft red variety, but there is at the same time a considerable area under the finer qualities of soft white wheat.

2. Sind.

We have very little of a special character to say regarding the Sind wheats and wheat-cultivation. In every feature Sind may be said to be intermediate between Bombay and the Pánjab. In certain parts of the country the methods of cultivation, the nature of the soil, and the character of the wheats are similar, but in other parts of the province an approximation

is seen to the wheats of Northern Bombay. The Sind wheats are generally pronounced superior to those of Bombay, and possess a larger proportion of soft white forms. The delta wheats are, however, specially liable to rust. Most of the Sind wheats are, as in the Pánjab, repeatedly watered or flooded during their growth. A dry crop (*see* the remarks under Bombay and Central Provinces) is, however, raised on lands that were inundated during the rains. On the water subsiding, these *band-baráni* soils are repeatedly ploughed, and the crop sown, no further watering being necessary.

3. Central India and Rajputana.

There is little occasion to dwell upon this province. In climate and soil it closely approaches to the Panjáb, and its wheats are accordingly similar. The Commissioner of Ajmir-Merwara writes that the natives invariably select the best lands for their wheat, and generally that in the neighbourhood of a tank or well, from which it may be irrigated. The soil is of a light, sandy loam, unlike the stiff loams of England on which wheat is grown.

To obtain a full crop, the land is fallowed during the rainy season (June to September); during this period it is ploughed two or three times a month to a depth of four inches. At the close of the rains a heavy plank is drawn over the field, which serves the purpose of a roller in pulverising the surface, and prevents also the moisture escaping. The sowing season begins about October 25, and lasts till the end of November, the crop being reaped in April. The quantity sown is about 2 bushels to the acre, and, if manured and irrigated, the yield is about 34 bushels. On unmanured and unirrigated, the yield is perhaps not more than 7 bushels. If no winter rain falls the crop is irrigated three or four times.

It is perhaps needless to extract the opinions that have been given for the wheat-cultivation in the numerous States that go to make up the province of Central India.

4. Bombay.

The total area of this Presidency, including Sind and the Feudatory and Tributary States, as given by the Survey Department, is 196,313 square miles. Of this region the area for which certain agricultural statistics have been prepared is shown by the table on page 11 to be 71,369,639 acres, but more detailed and accurate returns have been prepared for 52,183,254 acres. The area, even of the surveyed portion of Bombay, available

for cultivation, namely, 6,389,034 acres, is by no means inconsiderable, but we have no space to deal with this subject in detail, and must rest satisfied that the examples we have given under the Panjáb fully establish the fact that the land declared as available for cultivation means actually soil that awaits but human labour to throw it under crops.

The figures on page 11 corroborate a great deal of what we have endeavoured to show as to the relative importance of the crops. The millets and pulses are infinitely more important than wheat or rice. Taking the two principal millets, *jowar* and *bajra*, these occupy 13,011,636 acres, while wheat and rice cover a little less than a third of that area. Indeed, the pulses alone occupy more ground than either wheat or rice, but of course this would not be apparent to a visitor passing through the country during the wheat season, because of the fact that they are grown throughout the year, each peculiar species having its own definite season.

Soils.—The soils of Bombay are much more diversified than in the Panjáb. Sind and certain parts of Bombay bordering on Sind and Central India possess almost identical soils to those we have described, light loams with a tendency to run into a superabundance of sand. But in many parts of Bombay a heavy red soil prevails, containing iron, and in other districts a heavy black soil which gradually approximates to the black cotton soil more immediately characteristic of the Central Provinces (*see* page 43). Selecting a representative district for each of the divisions Gujarat, Deccan, Karnátak, and the Konkan, the following abstracts from the Gazetteers and other reports will give a general conception of the soils of Bombay :—

In the ***Broach*** district the soil is said to consist of two kinds, a light soil and a black soil; but each of these types of soils is capable of subdivision. The light soil, *gorát*, *gorádu*, or *márwa*, varies from sand drifts in the south to the richest alluvial loam, *bhálka*, found in the neighbourhood of the Narbuda. So in a like manner the *káli*, or black soils, range from the rich alluvial deposits of the Narbuda, to the regular deep cotton mould, *kánam*, to the shallower and harsher soils, *bára*, near the sea-coast, on which little else but wheat can be grown. These black soils occupy more than three fourths of the cultivable area.

In *Nasik*, as representing the Deccan, land is primarily classed as hill land, *dángi*, and plains, *deshi*. The former are poor and wholly dependent on the rains for moisture, and, except the portions devoted to rice, the remainder cannot be cultivated for two years consecutively. Of the plains land there are said to be four kinds: black *káli*, red *mál*, red and black *korál*, and light brown *barad*. Except in the uplands black soil is deep and very rich, and yields excellent cold-weather crops of wheat and gram. Red soil is found chiefly on hilly undulations, and yields good rainy season crops. The mixed red and black and the light brown soils are much inferior to the others, and often yield no crops at all when the rain is scanty.

In the *Belgaum* district of the Karnátak there are said to be two soils, red and black. The red soils are primary soils—that is, they are the direct

result of the decomposition of the iron-bearing rocks. This soil is generally found all along the western border; but it occasionally occurs in the plains country. The black soils are secondary soils—that is, they are rock ruins changed by the addition of organic matter. The black soil covers most of the plains country, and is best suited for the growth of cotton, Indian millet, wheat, and gram.

Seasons and Crops.—With very slight local modifications the two seasons we have already discussed in such detail are also observed in Bombay, but, if anything, there is a more pronounced third crop. The *kharif* is often known as the *mungári*, and the *rabi* as *lingári*. Most writers on this subject dwell at some length on the division into dry crops, *jiráyat*, and wet crops, *bagayát*, dividing the former into *kharif* and *rabi*. As emphasising what we have drawn attention to—namely, the wide range of crops the Indian farmer has to choose from—it may be here mentioned that in some parts of Bombay, as, for example, in Kolhapur, the year is divided into twenty-seven seasons, each of thirteen and a half days. These correspond with the lunar asterisms (or *nakshatras*), and regulate every field operation.

Methods of Wheat-Cultivation.—The system pursued with the finer wheats is briefly conveyed in the following:—

Bakshi is the best kind of wheat raised in the Deccan and Southern Marátha country. It is either black-bearded or straw-colour bearded. The grain is large and hard and contains a large proportion of gluten. This wheat, not being hardy, is not largely cultivated.

System of cultivation.—The land is ploughed twice, once length- and once cross-ways, with a six- or eight-bullock plough, according to the nature of the soil. The land is then harrowed six times, thrice with a four-bullock harrow and thrice with a two-bullock harrow, and then sown with wheat. This is all that is considered necessary. It is not customary to raise wheat on the same lands annually. The rotation generally adopted on dry-crop land is as follows: 1st year *jowari*, 2nd year *bàjri*, 3rd year wheat. On garden lands two crops are annually raised as follows:—

1st year.	2nd year.	3rd year.
1st crop *bàjri*.	1st crop *bàjri*.	1st crop *bàjri*.
2nd crop wheat.	2nd crop gram.	2nd crop wheat.

Instead of wheat or gram for a second crop, onions, potatoes, &c., are sometimes raised.

From the above, also, we obtain a general conception of the system of rotation. As contrasting this system, which approximates to the more careful cultivation of the Panjáb, we have an example of the extreme opposite type. Of Khándesh it is reported:—

"Before sowing with wheat, the ground is never ploughed, only three or four times laid open with the hoe to the sun, rain, and wind. If the ground is so damp that the clay sticks in balls, sowing begins in October or November, and in some of the Tapti Valley districts as early as September. The allowance of seed is from forty-five to seventy-five pounds an acre. A shower or two when the crop is shooting is useful, though by no means necessary. With cool seasonable weather and heavy dews, wheat flourishes without rain."

It is impossible to forget the care with which wheat is reared in the Panjáb and the North-West Provinces, the numerous ploughings and frequent waterings that are deemed indispensable, and hence the contrast with the cultivation and character of the wheat conveyed by the last quotation forces the conviction that these facts can alone be explained by the supposition that local adaptations have produced widely different products. In nearly every account of Bombay wheat there occurs the remark of certain varieties being "dry crop"—that is, wheats grown on dry lands, and which do not require to be watered.

At the same time a fact of the greatest interest has, along with this supposed commonplace idea, passed current without calling forth any special comment. In nearly every report a form of wheat known as *khaplé* is described as a wheat that requires much watering. There seems little doubt from the brief descriptions that have appeared of this wheat that it is a form of spelt-wheat. We have seen spelt-wheat sent from the mountains of South India, but have always suspected that it may have probably been a modern introduction. Here, however, there would appear to be no grounds for such an opinion. It is grown all over the Western Presidency, and it is quite possible its area of cultivation may extend to Southern India. Apart from the possibility of hybridisation with the ordinary wheat having exercised some influence towards the production of some of the most striking forms of Bombay hard wheat, the existence in India of an anciently cultivated wheat belonging to the series of which *Triticum spelta* is the type must upset materially a great deal of what has been written regarding the history of wheat.

M. de Candolle, in his valuable work on the "Origin of Cultivated Plants," says: "Spelt has no name in Sanskrit, nor in any modern Indian languages, nor in Persian, and therefore, of course, none in Chinese." He arrives at the conclusion that it most probably was derived in Europe in, comparatively speaking, modern times from the common wheat. By way of showing that there is at least a strong probability that the *khaplé* wheat of Bombay is a form of spelt, we may reproduce one or two passages regarding it. In the "Poona Gazetteer" there occurs the remark:—

"*Kaphlé* is the wheat usually grown in gardens. It is very hardy. It owes its name to the fact that the grain cannot be separated from the husk without pounding. It is sown as a second or *dusota* crop in January or February on irrigated lands after *bàjri*, maize, tobacco, chillies, or wheat, with good results."

We have here in itself a fact of very considerable interest—namely, that, as with rice, we *do* actually possess in India a wheat

that may be grown as an early *kharif* crop. Were there no other points of attraction this alone is well worthy of being followed up and put to a final test. It is much to be deprecated that, while volumes have been written upon every side issue of the wheat trade, no scientific investigation has been instituted into the subject of the varieties of wheat grown in India. Such an inquiry would doubtless lead to decided advances towards establishing the reasons for their peculiar adaptabilities. With such a knowledge, it would not be necessary to grope so much in the dark in the matter of efforts to introduce better varieties from one part of India to another. We have not, however, at present the means at our disposal to verify the suggestion contained in the above explanation of the *khaplé* form of Bombay wheat, and as our readers may not have access to the numerous records in which brief passages occur regarding it, we may extract one or two more passages.

In the "Ahmednagar Gazetteer" it is stated: "*Khaplé*, also called *jod*, is very hardy; but requires pounding to separate the husk." In Kolhapur it is said, "*Khaplé* is largely grown in watered lands as a crop alternately with sugar-cane. The grain is coated with an adhering husk, which cannot be separated without pounding."

We venture to think that the announcement that spelt-wheat is one of the forms of that cereal regularly and extensively grown in India, while perhaps not of commercial importance, will be, nevertheless, received with no small degree of interest.

There is something altogether peculiar and exceptional in the wheats of Bombay. Their hardness and redness may to some extent be due to soil, and the presence, for example, of iron may have a good deal to say to this; but there are special forms readily cultivated by methods and under conditions that would be utterly fruitless with any known form of Panjáb wheat. Indeed, it is difficult to understand why Panjáb and Sind wheats have not been introduced into large tracts of the northern section of Bombay, and the wheats of the Central Provinces into the southern. These wheats would be vast improvements on the wheats generally produced in Bombay.

Experiments with English pedigree wheats have been made, but apparently attended with much less success than we find recorded in 1866 in connection with the district of Saugor in the Central Provinces. At the same time we read of efforts having been made to furnish the cultivator with carefully hand-picked soft white and soft red wheats, and of the effort to, in this way, improve the stock having been abandoned as fruitless. It is hardly possible to escape from the conclusion that the more rational course would be to carefully investigate the botanical

characters of the species or races of wheat grown, and the relation these bear to the peculiar climates and chemical nature of the soils under which they are grown. To attempt to introduce a wheat of characteristics widely different from the data thus obtained would only be to court failure.

There are no special modifications of the methods of ploughing, sowing, reaping, thrashing, or winnowing that call for very special mention: except the fact that in many districts, instead of reaping by means of a sickle, the plants are pulled out by the root. A much more complete and scientific rotation is followed, however, as we have shown above, and manure is more fully appreciated and more extensively used in Bombay than in Panjáb agriculture. The whole system, however, of wheat-production is even less scientific, and certainly less careful, than that pursued in the Panjáb. The drill plough seems to be universally employed.

5. North-West Provinces and Oudh.

It is scarcely necessary to dwell at any great length on the wheat of these provinces, since the account given by Messrs. Duthie and Fuller in their well-known work published by Government on the "Field and Garden Crops of the North-West Provinces" contains practically all that is known. It is much to be regretted that a similar brief abstract has not been prepared for each province. We shall extract from the "Field and Garden Crops" some of the more noteworthy facts, and bring these up to date, when necessary, from more recent publications.

"The countless varieties and sub-varieties of wheat which are grown in these provinces speak volumes for the importance of the part which it plays in the agriculture of the country. It is only with rice that we find anything like the differentiation which years of natural and artificial selection have produced in wheat. The most convenient primary subdivisions of wheat is into starchy and glutinous, or soft and hard, the former containing a larger proportion than the average of starch, and being thus especially fit for the production of fine flour (*maida*), while in the wheats of the latter class gluten predominates, rendering the grain especially productive of semolina (*saji*). Grains of the first class break easily, with an opaque pure-white fracture, whilst those of the second class are difficult to break or bite, and appear more or less translucent."

This distinction we have assumed to be fully understood, and hence have continued to speak of hard and of soft wheats without defining them. The above passage fully specifies the practical and chemical peculiarities implied.

The growth of flour-mills in Bombay, and the immense importance of *saji* as an article of food throughout India, makes it necessary to explain that *saji* is the granular meal obtained

by moistening the grain overnight, then grinding it. The fine flour passes through a coarse sieve, and the *saji* and bran are left above. The bran is separated by winnowing, and there remains the round granular meal (or central pieces of the grain) which is used throughout India in place of oatmeal. The flour that passed through the sieve is once more ground, and passed through a finer sieve, the fine flour, *maida*, passing through, and the coarser grained, *atta*, remaining above. Of course, *maida* and *atta* are prepared without moistening and separating *saji*, the grain being ground at once into *maida* and *atta*. This point is of some interest, since from a native point of view the quality of wheat is judged of from the amount of *saji* it will yield, and the process of damping the grain has a distinct bearing on the modern European process of damping before milling, or by obtaining the required moisture by mixing the dry Indian wheats with damper grains before milling. The degree of "drinking" is a source of distinct gain to the dealer in Indian wheats, and accounts for the much higher yield of bread as compared with other wheats.

Soils.—Wheat is grown in almost every soil, except the very lightest sand; a rather heavy loam is considered best suited for it. In fact, what we said about the Panjáb wheats applies in its full force to those of these provinces. Manure is applied to the better class of wheatfields generally every second or third year, though in quantities which would sound ridiculously small to the English farmer, 4 tons (=100 maunds nearly) being about the average to the acre. Land is occasionally prepared by herding sheep in the fields. This same practice prevails in the Panjáb, and a case is recorded of a prosecution because a periodical flock of sheep, which for years had herded on a particular farm, were by the owner taken to a neighbouring farm instead. A curious habit also prevails in Northern India of herding sheep, and even cattle, on the field of wheat so as to top-manure the soil and cut down the too rapid growth of the crop. Sometimes it is even cut to effect this purpose, the reason being that the crop is supposed to sprout more freely. We have not seen returns of the number of shoots to each stock of Indian wheat, but we have carefully examined the hill wheats, and the average is from four to ten. Doubtless the grazing or cutting down of the young crop would have the effect of increasing the number of shoots.

Seasons and Crops.—There is nothing of any special character to record under this head. A second wheat crop such as we have commented on in connection with Bombay apparently does not exist. The wheat is entirely *rabi*, sown at the end of October and beginning of November, the harvest taking place

from March to April. As a rule, it is only sown in land that was left fallow during the preceding *kharif* (known as *chaumás* or *púral*); but in highly manured lands near village sites it occasionally follows maize, that crop being cut only six or eight weeks before the wheat is sown.

Rotation.—No particular rotation is known to be followed, but in tracts where cotton is widely grown, wheat is generally said to follow it—probably, however, merely because cotton in the *kharif*, like wheat in the *rabi*, is the crop which is principally grown on the best land of the village ("Field and Garden Crops"). In the Meerut district, at least, a very elaborate rotation is observed, in which wheat is grown only twice in five years.

The following statement shows the areas of cultivation in Oudh at three different periods:—

Area of the chief Crops of Oudh in Acres.

Crop	1879–80	1881–82	1885–86
Rice	1,550,514	1,743,015	2,159,425
Wheat	1,747,017	1,863,750	1,556,198
Other grains	5,297,417	5,490,417	6,013,995
Oil-seeds	295,191	241,213	314,934
Sugar	96,992	142,580	142,484
Cotton	30,200	51,113	72,030

The wheat area actually declined in 1883–84 by 458,645 acres, but increased again in 1884–85 by 70,000 acres. In the last year of the table the cultivated area increased over that of the preceding year by 112,000 acres, of which twenty per cent. was rice, and sixty per cent. oil-seeds. Since 1879–80, the year when the wheat trade assumed some importance, the area under food grains (that is, millets and pulses) has increased by nearly one million acres, while the area under wheat has declined. In the last column the figures given were made to carefully separate the returns from twice-cropping, so that in some respects the increase is shown a little too high. Of the total area under crops, namely, 11,025,802 acres, 2,206,739 yielded two crops, which would lower the actual area cultivated to 8,819,063 acres, since the second crop would increase the supply of millets and pulses.

Methods of Cultivation.—We have little of special importance to record under this head. The systems we have described under the Panjáb apply in their full force to the North-West Provinces. The soil is carefully and frequently ploughed, the number varying within wide limits.

Twenty ploughings are reported as not uncommon in Gorakhpur, while two or three are held sufficient in the black soil of Bundelkhand. Eight

ploughings may be taken as the average. It is deemed essential that the land should be ploughed at the commencement of the rains, so as to lie in open furrows and drink in the whole of the rain which falls. If the ground is very damp the seed is sometimes sown broadcast and ploughed in, when it is not buried more than one inch below the surface, and is less likely to rot than if buried deeply. But the two commonest methods of sowing are—

(1) By simply following the plough and dropping the seed into the furrow made by it, the seed being covered by the earth thrown up by the next furrow, and

(2) By dropping the seed down a bamboo fastened to the plough stilt.

The amount of seed to the acre greatly varies, but may be said to be abnormally high. This fact is, indeed, sometimes urged against wheat-cultivation. The poorer cultivators have to buy from the merchant (or rather get the grain on loan at high interest collected at harvest), and are at the same time compelled to accept whatever seed the trader of the district chances to have in stock. A very extensive correspondence has passed between the various Governments of India on the subject of the amount of seed required per acre. Several experiments have also been made at the Government farms, which have all tended to confirm the native practice. In the North-West Provinces the quantity of seed varies from 100 to 140 lbs. an acre; but in Bombay it is often much lower than this.

Harvesting and Winnowing is similar to that described; the grain being cut with a sickle, and not pulled out by the root—a habit which prevails to a large extent in Bombay.

Messrs. Duthie and Fuller have gone into the subject of the cost of production of an acre of wheat. This may be stated briefly :—

Expenditure for labour and seed	Rs. 16	0	0
Irrigation and labour	5	7	0
Manure	3	0	0
Rent of land	7	0	0
Grand total	Rs. 31	7	0

After very careful investigation they arrived at the conclusion that the lowest average yield for irrigated land was 15 maunds an acre of wheat grown alone, as also for wheat-barley, and 13 maunds for wheat-gram. For unirrigated lands they estimated 8–9 maunds a fair average. After a long series of experiments extending over many years, the Settlement Officer of Bareilly district gave the average for irrigated and unirrigated lands collectively as 12 maunds (975 lbs. $=81\frac{1}{4}$ lbs. per maund). In Cawnpore irrigated fields were found to give 17 maunds, or 1,402 lbs. $= 82\frac{1}{2}$ lbs. per maund; and unirrigated,

8 maunds, or 635 lbs. = $79\frac{3}{8}$ lbs. per maund.[1] The smallest recorded out-turn from unirrigated land was 500 lbs.

The price of wheat fluctuates so rapidly that it would be unsafe to represent the profits of the producer; but the above figures will afford the means of an approximate opinion being formed.

6. Central Provinces.

We have indicated that the great alluvial basin of the Ganges sweeps round the foot of the Himálayas, and isolates the tableland of Central and South India. Space will not admit of our dealing with the minor subdivisions of this tableland separately. We must be content with conveying a general impression of the features of the Central Provinces as representing Berar and Hyderabad, especially when taken in the light of what has been said regarding the more southern section of Bombay.

There are in these provinces 7,705,263 acres available for cultivation. In perhaps no other province can the literal meaning of this be more clearly demonstrated. The provinces are poorly inhabited, and within periods recorded in our Settlement reports large tracts of land have been taken up and brought into cultivation. The returns first obtained are well-known, and important records have been kept of the deterioration of productiveness. The results have been identical with those obtained in America. The newly reclaimed land gave twenty and thirty-fold for a few years, but rapidly deteriorated until it reached a fixed, or relatively fixed, position. The district officers repeat in their annual reports that there are still vast tracts of land on which this process might be repeated. In perhaps no other part of India is the principle of paucity of population, large holdings, and correspondingly low systems of agriculture more forcibly demonstrated. In the North-West Provinces small holdings and careful cultivation have produced results that, even with the present agricultural appliances, compare favourably with Europe. In the Central Provinces, on the other hand, the proprietor of a large estate is satisfied with the comparatively small results obtained by cheap and primitive means.

Soil.—To understand the Central Provinces it is necessary to recall their geological peculiarities. The great basaltic formation, known as the Deccan trap, occupies nearly a third of the peninsula. This extends south-west from Rajputana to the sea-coast, considerably to the south of Poona. It thus crosses

[1] There are different local maunds; but a commercial maund of wheat is 82 lbs. (exactly $82\frac{1}{16}$ lbs.)

the north-western division of the Central Provinces, and slopes north-west in the drainage areas of the Narbuda and Tapti rivers, and south-east in the drainage area of the Godavari. To the south and south-east of the Deccan trap there extends the vast region of the archæan rocks of India. These two geological regions are broken by isolated patches of the Gondwana rocks, which follow chiefly the present beds of the great rivers, and by the vastly older formation known as the Vindhyan. The disintegration of these rocks has contributed to the local peculiarities of the soils common through the tableland, although the rivers have to a certain extent distributed and amalgamated the results. The wheatfields of the northern section bordering on the Narbuda owe to a large extent their fertility to the Deccan trap, just as the ricefields to the east doubtless are indebted to the Gondwana and Vindhyan rocks in the region of the Mahanadi.

Various opinions have been given as to the source of the so-called "black cotton soil." Without entering into this discussion, we may quote here Mr. Fuller's description of the local modifications of the "black or cotton soil":—

"This black or 'cotton' soil is known by various names, indicating the proportion in which it is mixed with lighter soil. It is of very variable depth, lying in much thicker deposits in flat valleys than on sloping ground. It is most suitable for wheat when at its greatest thickness, since, from the great capacity which it then enjoys of absorbing rain-water, it can, in a monsoon of average intensity, lay up a store of moisture sufficient to carry a wheat crop through a cold season in which the winter rains hold off entirely. When it is merely a shallow veneer of earth, covering rocks, it dries, of course, with far greater rapidity, and is in this case devoted to the production of rain (or *kharif*) crops. This difference is brought out into strong relief by a comparison of the agricultural returns for the contiguous districts of Hoshangabad and Nimar. In Hoshangabad deep black soil predominates, and, in consequence, 63 per cent. of its cultivated area is returned as under wheat. The greater portion of the Nimar district is hilly or undulating ground, consisting of trap rock, overlaid with a shallow bed of black soil. Wheat only occupies 4 per cent. of its cultivated area."

Seasons and Crops.—Again quoting Mr. Fuller, from whom much that we have written of these provinces has been derived:—

"The alternation of *rabi* and *kharif* crops is not so common in these provinces as in Upper India, since the soils are of a more marked diversity, and are, therefore, more strictly approximated, some to autumn and others to cold-weather crops."

In the use of manure there is considerable diversity. It is hardly ever applied to land in the Narbuda valley; while in Nimar, and in the districts of the Nagpur division, its utility is fully recognised, each wheatfield receiving a manuring, if possible, once in three years. The explanation may lie in the

greater effectiveness of manure on shallow than on deep lands. On the former it makes all the difference between a fair crop and no crop at all, while on the latter it would merely add in some degree to a fertility which is as yet very far from being exhausted.

Methods of Cultivation.—The system to which we have alluded as practised in the heavy black soils of Bombay is practically that pursued in these provinces. It differs materially from the system followed in the North-West Provinces and the Panjáb; but it is probable that, while improvement is possible, the two countries, even in the hands of European farmers, would be tilled by widely different methods.

"For ordinary wheat-cultivation, operations commence in April or May, when the surface of the ground is scarified with a hoe-plough. After the setting in of the monsoons the surface is again scarified, once in July and once in August, if, as is hoped, there is a long enough break in the rains to allow the ground to become sufficiently dry to bear the plough-cattle. A fourth hoeing—the most necessary of all—is given in September, towards the end of the rains, the importance of which arises from the fact that loss of moisture by evaporation is much checked if the surface of the ground be in a loose condition. A final hoeing is given at the beginning of October, after which the field is ready for sowing. This represents the preparation which a careful cultivator will give his land under favourable circumstances, and, as a rule, land seldom receives more than two or three hoeings before it is sown."

"The seed is occasionally sown broadcast and ploughed in, but is more generally drilled in, the implement used for the purpose being an ordinary plough, or, more properly, 'grubber,' fitted with a bamboo-tube alongside of the stilt, down which the seed is dropped."

Irrigation is almost confined to the sugar-cane and garden crops. It is impossible, however, to say whether, with a greater press of population, irrigation may not be gradually extended to wheat.

Quantity of Seed and Yield.—From about 80 to 120 lbs. of seed to the acre prevails in these provinces. In connection with the seed required in the North-West Provinces we have already alluded to the confirmation that by experiment has been arrived at regarding the quantity necessary. The idea that 120 lbs. an acre is high arises from a comparison with other Indian crops. It is, in fact, very nearly that employed by the English farmer —two bushels to the acre. We have, however, seen that in Nasik only 24 to 80 lbs. are used to the acre.

The question of yield has now in many provinces of India been put to a final test. From the supposed deterioration of the soil in the Central Provinces it was observed that, if this had actually occurred, the richest districts would long before this time have endured the utmost deprivation. The Deputy Commissioner of Raipur, for example, showed that if the rice crop of

his district had been in reality what it was officially reported to have been, a large proportion of the population must have died of starvation—and this, too, in a district notorious for plenty, and from which there has been for many years past a regular export of food grain of an exceptionally large amount. This observation aroused the attention of the authorities, and instructions were accordingly issued that trial harvests were to be supervised by high responsible European officers. Certain fields that had been cultivated by the owners were harvested in the presence of the officer appointed to supervise the experiment in each district. A large number of these trial harvests have been made, the result being that the normal yield per acre has been determined with the utmost degree of accuracy. This has shown a considerable increase in the yield of every crop experimented with.

In the Raipur district the results of five harvests gave a mean of 1,048 lbs.; of seventeen harvests in Nimar, 902 lbs.; and of thirteen in Narsinghpur, 647 lbs. The lowest yield was that of Hoshangabad, where the mean of four harvests was 382 lbs. Without going into this matter in great detail, it may be added that the opinions held, both by Government and the public, as to the low yield in the Central Provinces have been shown to have been founded on prejudiced returns. We have in connection with the Panjáb referred to the difficulty experienced in getting the natives to furnish accurate information as to their profits. It may fully be anticipated that like results to the above will follow in Upper India when the Government feels called upon to direct test harvests to be made in the Panjáb as have now taken place in the Central Provinces. We have given the yield in the Panjáb as it is at present stated to be, but feel sure a higher average must prevail. Reverting to the yield in the Central Provinces, it may, in conclusion, be said that in Raipur the yield in the older reports is put down at 368 lbs. (instead of what it has now been found to be, 1,048 lbs.), and in Narsinghpur at 200 lbs. (instead of 647 lbs.). These are test examples, and it may be inferred that in the poor districts the early records were found to be relatively more nearly correct than in the rich. Thus, for example, in Hoshangabad, instead of 382 lbs., the return was fixed at 328 lbs.

The rents paid for wheat lands in these provinces vary considerably, according to the nature of the soil and the facilities of export. The average in Hoshangabad is 1*r.* 9*a.* 3*p.*, in Saugor 1*r.* 14*a.*, in Bilaspur 14*a.*, in Jubbulpur 2*rs.* 4*a.* The effect of railways is nowhere more marked than in the Central Provinces. The peculiar wheats that are now grown are different from those of former days. It is well known that

"Natives prefer for ordinary consumption the hard glutinous varieties to the soft white varieties, which are principally in demand for the English market. Before the commencement of the annual drain of wheat to Bombay, soft wheat of the kind known as *pissi* was held in very low estimation, and commanded a price which ruled from 8 to 10 per cent. lower than that of the hard *kathia* variety. Now its price is at least 12 per cent. higher than that of *kathia*. In old days it was no uncommon stipulation of a ploughman contracting for service that he should not have to eat *pissi* wheat more than twice a week. Now a ploughman who demanded it twice would certainly not receive it. *Pissi* wheat is grown on lighter land than *kathia*, and it is reported from both Saugor and Narsinghpur that the value of light land has risen in considerably larger proportion than that of heavy land, in consequence of the request in which *pissi* wheat now stands for the Bombay market."

7. Madras, Mysore, and Hyderabad.

It is impossible to deal with these provinces in detail. The wheat of Madras is of little importance. According to the last returns there were only 30,275 acres under that crop. There are no returns of wheat in Coorg, but in Berar there were 808,515 acres under wheat in 1886, and in the Nizam's dominions wheat is also cultivated to a considerable extent. Berar wheat resembles in many respects that of Bombay and the Central Provinces, and it would, therefore, not seem desirable to practically repeat what has already been written.

8. Bengal, Assam, and Burma.

There is no wheat grown in Lower Burma. We have seen wheat being cultivated, to a small extent, in the Native State of Manipur—a small territory between Burma and Assam. It is, therefore, possible that wheat may even now be grown in Upper Burma to some extent, but we have no definite information. There is not the slightest reason, however, if cultivators could be induced to settle in Upper Burma, but that a rival to Russia and America might appear of which the world is ignorant at present. A small amount of wheat is grown in Assam, but only for home use—none has as yet been exported from that province. The same remark might almost apply to the greater part of Lower Bengal. A limited amount is annually grown in the basins of the rivers, upon flat, periodically enriched lands, but the amount is inconsiderable. In the upper portions of Bengal, however, or the districts bordering on Behar, and in Behar itself, the area under wheat is very considerable.

A long and instructive report has recently been issued by the Bengal Agricultural Department, from which we gather the area under wheat to be:—

	Acres.
Behar	678,500
Bhagulpur	303,600
Burdwan	4,709
Chutía Nagpur	1,500
Orissa	1,100
Total	989,409

At the experimental farms in Bengal a most useful series of experiments have recently been performed with the view to determining the manures best suited for wheat. It is somewhat surprising that in all similar experiments throughout India, on the most diversified of soils, the result should have been the same, namely, that the best returns of wheat are obtained by a manure containing nitrogen.

One of the finest wheats in India is that grown at Buxar, in Bengal. Efforts, more or less successful, have been made to encourage the cultivation of this wheat in every part of the province where it is found possible.

The bulk of the wheats shipped, however, from Calcutta, and which appear in the foreign markets as Bengal wheats, are not grown in that province. It is impossible to look at the returns of the wheat imported to and exported from Calcutta during the past eight or ten years without feeling that there must surely be some undercurrent affecting the trade far more powerfully than the extension of railway communication.

	Maunds.		Maunds.
1877–78	71,30,477	1881–82	1,07,86,269
1878–79	26,46,683	1882–83	73,08,081
1879–80	37,93,514	1883–84	1,12,12,086
1880–81	71,18,198	1884–85	46,97,139

These were the imports into Calcutta during the years indicated. But taking the two chief provinces from which the wheat is obtained, we have the following result:—

	Behar	North-West Provinces
	Maunds	Maunds
1877–78	20,03,787	31,38,034
1878–79	9,83,645	11,03,382
1879–80	16,09,729	14,92,312
1880–81	39,75,726	18,90,523
1881–82	47,25,218	45,89,877
1882–83	22,42,249	43,33,111
1883–84	33,54,234	70,47,837
1884–85	9,91,048	30,81,031

Are these fluctuations natural, and do the figures indicate a decline in the trade; or, in its erratic course, shall we see it exceeding the maximum hitherto attained? Of course, the

railways recently opened out have diverted to Bombay and Karachi a large proportion of the wheat that used to find its way to Calcutta.

There is, however, a strong feeling that the severity with which the Calcutta merchants seem to wish to preserve the minimum refraction, at five per cent., is distinctly operating in the direction of lowering rather than enhancing the trade. This is too large a question to deal with in this place. Its issues extend to Europe. We were once walking through the Exchange where samples are exhibited on which the Mark Lane trade is transacted. One of the most influential corn-merchants in town thrust his hand into a sack of Indian wheat and exhibited the dirt it contained. Pointing to the gram in one sample, the barley in another, he remarked, "Could you send us your wheats free of mud, and not adulterated with these other grains? It would command a much higher market." The reply might fairly well have been given, "When you use your influence with your Indian agents to abolish a fixed rate of refraction, Indian wheat within a twelvemonth will reach the market in a perfectly clean condition."

It would be absurd to expect a cultivator to sell clean wheat when he would be paid exactly at the same rate as if it contained five per cent. of dirt. That is precisely the position; and the Bombay Chamber of Commerce appears to be giving indications of a desire to lower the rate of refraction to two per cent. Why not abolish it entirely, and pay lower rates for all adulterated wheats? One Bombay firm has announced that it will pay at a higher rate for clean wheat than for wheat containing dirt and impurities.

A most elaborate investigation has been instituted in every province of India into the question of this adulteration. With few exceptions, indeed, it has been found that the cultivator takes no part in the trade of adulteration. His methods of winnowing and storing are imperfect, but there is no inducement to modify this. He can clean now his grain, by the means at his disposal, considerably below the rate of refraction. He makes no gain by producing clean; on the contrary, he is perfectly well aware that the middle-men employed by the exporting firms adulterate the grain before making it over to the firms that pay them at a minimum rate of five per cent. refraction.

An extensive correspondence has passed on this subject. The Indian Chambers of Commerce keep recommending to Government that the only action that can be taken is to urge upon the cultivators to grow only the better-class wheats, to avoid growing mixed crops, and to endeavour to produce as

clean a grain as possible. For what purpose? That specially prepared particles of mud, to the extent of the five per cent., may be added by the middle-man at the cost of the cultivator, who is paid as if it had been there originally. After all, the export trade is by no means the largest market for Indian wheat. The returns from every corner of the empire are full of notices to the effect that "no wheat is exported from this district, although it is largely grown."

A careful perusal of very nearly everything that has been written on Indian wheat leaves the impression that but for the effect of the Indian exports on the English farmer we should have known as little to-day of the wheat trade as we do of the rice—a trade that continues to bear a heavy export duty of over fourteen per cent. Rice is practically the only article of Indian produce (opium being excepted) that bears an export duty; and, in spite of all this, more rice is exported than wheat.

We have endeavoured to convey an impartial impression of the position and character of the cultivation of wheat in India. We have shown that India possesses immense natural capabilities, that her commercial facilities are improving, her population on the increase, and her agriculture (if anything) too prosperous in relation to her manufactures. But we have also shown that, while this is so, there is little to warrant the alarm that the selfish and primitive modes of agriculture pursued by her farming classes will soon lead to a disastrous reduction in the fertility of her soil. These primitive modes will no doubt be replaced, with the advance of national wealth and education, by more scientific systems of cultivation; but even when this point has been reached, we shall still be justified in inferring from our premisses that the agricultural area of her territory will not have been exhausted, nor its fruitfulness reduced below the point of affording employment to her numerous peasantry. Without entering, however, too elaborately into the debatable theme of the deterioration of the Indian soil—a deterioration which, if it exists at all, has presumably taken place during the lapse of centuries—it may safely be asserted that no new light has as yet been thrown on the subject, no valid argument adduced to justify the anticipation that a second hundred years will find the wheatfields of India less fruitful than they were a century ago.

The English farmer, then, would err as much by giving too anxious a credence to the alarmist outcries of an immediate reversion of India's agricultural prosperity as by indulging in a too sanguine anticipation of a rapid development disastrous to European agriculture. We have hinted that breakers are seen ahead even now in the preponderance of agricultural over indus-

trial enterprise. But when the throb of the steam-mill shall resound in every corner of India, a decline in European imports will occur, together with a marked falling-off in the annual payments for interest on foreign capital. This state of affairs, when it does come about, will leave a smaller surplus of produce for export; but as long as agriculture gives employment to the vast majority of the people, so long must the demand for European goods be paid for by agricultural exports. Wheat is remunerative now; but when it ceases to be so, other crops will be substituted, and agricultural enterprise thus continued. The people of India have few wants. When it will not pay them to sell wheat, they can live contentedly for a time on the produce of their fields, and wait for more favourable openings.

III.—*The Indian Wheat Trade.* By WILLIAM E. BEAR, Rydal Road, Streatham.

THE extent to which the price of wheat in this country has been affected by imports from India is a question upon which a great difference of opinion exists. On the one hand, it is contended that, as the quantity of wheat received from India is small in comparison with the total foreign supply, the great fall in values which has taken place during the last ten years cannot be attributed to the Indian contributions, especially as they have fallen off for the last two years from the maximum attained in 1885; while, on the other hand, it is urged that a comparatively small addition to supplies previously, as a rule, in excess of the demand, is quite sufficient to account for a great depreciation. Now, in considering these contrary opinions, it is first to be pointed out that the Indian exports to Europe, and not to the United Kingdom alone, should be considered in estimating their effect upon prices here, because supplies from a new source to any importing country in continental Europe set free an equal quantity in one or more of the exporting countries for our use, if we require it. For instance, if India sends a million quarters of wheat to Italy, which Russia would have supplied if it had not been for India, Russia can send us a million quarters more than she otherwise could have spared for our use. This is an important point, for, although the supplies of Indian wheat to this country fell off slightly in 1886, and greatly in 1887, the total exports from India in the financial year 1886–87 were greater than they had ever been before.

The following table is given in the latest issue of the "Statement of the Trade of British India":—

TWELVE YEARS' EXPORTS OF WHEAT FROM INDIA.

Year	Cwts.	Tens of rupees (Rx.)	Year	Cwts.	Tens of rupees (Rx.)
1875–76	2,498,185	901,026	1881–82	19,863,520	8,604,081
1876–77	5,583,336	1,956,333	1882–83	14,144,407	6,068,934
1877–78	6,340,150	2,856,990	1883–84	20,956,495	8,877,561
1878–79	1,044,709	513,779	1884–85	15,830,754	6,309,140
1879–80	2,195,550	1,121,015	1885–86	21,060,519	8,002,350
1880–81	7,444,375	3,277,942	1886–87	22,263,348	8,625,876

It was not until 1881–82 that the exports from India became sufficient to attract much attention. Previous to that date they had only thrice amounted to as much as a million quarters in a year—in 1876–77, when they were a little over $1\frac{1}{4}$ million quarters; in 1877–78, when the quantity was about $1\frac{1}{2}$ million; and in 1878–79, when it was not quite $1\frac{3}{4}$ million. In 1881–82, however, there was a sudden advance to over $4\frac{1}{2}$ million quarters, or, to give the exact quantity, to 4,584,000 qrs. In subsequent years the quantity has been three times in excess of that for 1881–82, and twice below it, and the largest totals have been 4,860,120 qrs. in 1885–86, and 5,137,693 qrs. in 1886–87.[1] Now, although India sent wheat to seventeen countries and colonies outside Europe in the latter year, no less than 4,757,172 qrs. out of the total exports came to Europe, while only 380,521 qrs. (of which Egypt received 304,074 qrs.) were shipped to extra-European ports. The proportions of the European supply of wheat from India in the latest year for which the details are published are given in the following table, in which the hundredweights of the official returns have been converted into quarters, according to the calculation adopted by the Board of Trade:—

EXPORTS OF WHEAT FROM INDIA, 1886–87.

	Qrs.
United Kingdom	2,231,060
Italy	1,202,840
France	647,000
Belgium	554,720
Holland	47,756
Spain	30,034
Malta	19,403
Gibraltar	12,540
Portugal	10,800
Austria	558
Greece	461
All Europe	4,757,172
Other countries	380,521
Total	5,137,693

[1] Another financial year has just closed, and, although the official figures are not yet available, it is known that the exports, in consequence of the deficiency

The other countries and colonies are Egypt, Arabia, Australia, Mauritius, Aden, Turkey in Asia, Straits Settlements, Réunion, Ceylon, Abyssinia, Zanzibar, Cape Colony, Persia, Mekran and Sonmiani, China, South America, and Mozambique. Of course, the quantities exported to some of these countries, which are named in the order of the quantities sent to them, received quite insignificant contributions. Indeed, bearing in mind the close connection of Egypt with the European wheat supply, Indian exports of that grain might, without causing much misapprehension, be reckoned as all for Europe.

In addition to wheat, India exports a small quantity of flour, but none of it comes to Europe. In 1886–87 the amount was 319,143 cwts., from which imports of 22,687 cwts. must be deducted, leaving the net exports 296,456 cwts. The quantity exported has increased five-fold since 1882–83. The "Miller," a journal which has published many valuable articles on the Indian wheat trade, regards the extension of flour-making in India not only without apprehension on behalf of British millers, but as actually advantageous to them. In an article on the "Oriental" Flour Mill, Bombay, in its issue of December 5 last, the "Miller" said:—

"The large supply of wheat in India convinced some of our most enterprising milling engineers that it was advisable to erect mills to manufacture flour in India for native consumption and to compete with American flour in the far East, and thus, without building up a dangerous rival to the milling interest at home, help the English milling trade in their competition with American flour by reducing the profits that the American millers are obtaining in China and Japan. Flour manufactured entirely from Indian wheats would not be acceptable to the home market on account of the peculiar feature in the gluten and the aromatic flavour in the flour."

It has been pointed out that the exports of wheat from India were not considerable until 1881–82, and, whether it be merely a coincidence, or more than that, it is a fact that the average annual price of wheat in England has been permanently below 45*s*. a quarter only since 1882. It has further been remarked that we must consider the total supplies of Indian wheat to Europe, and not those received in England only, in endeavouring to form a fair estimate of their effect upon prices here. Let us now see the proportions of our foreign wheat supplies received from India and the other principal sources in the calendar years most nearly corresponding to the Indian financial years referred to specially above. As the Indian financial year ends on March 31, and the new crop does not begin to move to any considerable extent before the middle of that month, it is clear

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of the wheat crop of 1887, have been much smaller than those of either of the two previous years.

that we should compare our imports in 1881 with Indian exports for 1881–82, and so on with later years. In 1881, then, we imported from India 1,693,560 qrs. of wheat; in 1885, the year of maximum as far as English imports only are concerned, the quantity was 2,809,676 qrs.; in 1886 it was 2,548,725 qrs.; and in 1887 there was a fall to 1,963,637 qrs. In the following table these quantities appear with those from the other principal sources (flour in wheat equivalents included), each source of as much as a million quarters being named in the short list:—

WHEAT AND FLOUR IMPORTED TO THE UNITED KINGDOM.

From	1881	1885	1886	1887
	Qrs.	Qrs.	Qrs.	Qrs.
India	1,693,560	2,809,676	2,544,725	1,963,637
United States	10,547,144	8,985,730	8,983,880	11,615,950
Russia	947,147	2,788,244	872,829	1,282,312
Other sources	3,276,301	4,175,562	2,782,664	3,220,108
	16,464,152	18,759,212	15,184,098	18,082,007

These figures show that our receipts of wheat from India, which in only one previous year had been as much as 5 per cent. of our total foreign supplies, rose to 10·3 per cent. in 1881, to 15 per cent. in 1885, and to 16·7 per cent. in 1886. Surely such proportions are large enough to account for a great fall in prices, considering that they represented receipts from a new source of supply. It is true that the proportion fell to 10·9 per cent. in 1887, when American supplies were unusually large and Russian contributions considerable; but that was after prices had been brought down to an extremely low level, and is to be explained by the unusual deficiency of the crop of Indian wheat in 1887, following a crop below average in 1886.

Moreover, we received more wheat from Russia on account of extensive Indian exports to Italy than would otherwise have come to us. During the three years between 1881 and 1885, for which the quantities of our imports of Indian wheat have not been given, they averaged 2,130,284 qrs. per annum, and since 1881, including the diminished receipts in 1887, the average has been 2,284,814 qrs. per annum. As we had not felt the want of these new supplies, there was no natural demand for them, except at the expense of other exporting countries; and, as the other countries had prepared to meet our wants to the full, the large surplusage from India produced the effect always to be expected from a glut in the markets.

The full effect of the Indian supply upon prices, however, as already intimated, is only to be estimated by considering

the quantities sent to Europe. Now, during the six years ending with 1886–87, the average of those quantities exceeded 4,000,000 qrs. per annum. In proportion to the total wheat supply of Europe, the quantity is a small one; but it is a very large one to come on top of supplies already ample. It is important to notice that the period of the commencement of large exports of wheat from India to Europe was also the time at which wheat-production in the United States reached its maximum. In the three years following 1881 the quantity of wheat produced in the country last named was greater than it had been in any three previous years, or has been in the three succeeding years. Therefore there could not have been a time when the opening of a new source of wheat supply for Europe would have had a greater effect upon prices.

As the whole of continental Europe imports considerably less wheat and flour from outside countries than the United Kingdom alone, the proportion of the Indian contribution to the total European supply is larger than it has been shown to be in the case of this country, and has, consequently, a greater effect upon prices. Therefore, even if our receipts of Indian wheat should continue to decline, it will not be right to assume that the effect of exports from India is diminished, unless the quantities received in continental Europe also fall off. In 1882–83 India sent only 40,630 qrs. of wheat to Italy; whereas in 1886–87 the quantity was 1,202,840 qrs. There has been an annual increase during the period; but more than three-fourths of the augmentation occurred in the last year, when our receipts from India fell off. The explanation, as is pretty generally known, is that Indian wheat has been found peculiarly well fitted for the manufacture of macaroni and other *pâtes alimentaires*. For the same reason France has increased her consumption of Indian wheat, though not to the same extent as Italy.

It is scarcely necessary to say that I do not attribute the whole of the great fall in the price of wheat to the supplies from India. The fall has been general, nearly all commodities having been subjected to it, and no one could expect wheat to be an exception. But the fall in the price of that grain has been much in excess of the general fall in values, and the excessive depreciation, I believe, has been principally caused by the great increase in the exports of wheat from India to Europe. How that increase itself is to be accounted for, in the face of falling prices, is a question to be discussed hereafter. It is contended by some persons that the fall in prices has been occasioned by the diminished expense of producing and exporting wheat; but the explanation is obviously insufficient, because the combined savings referred to are certainly not equal to the

fall in price. That this statement is true may easily be proved in relation to the wheat-supply of America, the country which has gained most of all countries from the saving in expenses referred to.

The average "farm value" of wheat in that country, as stated by the Department of Agriculture, is outside the fluctuations of cost of transport, and the average farm value of a bushel of wheat in America fell from 119·3 cents in 1881, or from an average of 102 cents for the five years ending with 1881, to 68·7 cents in 1886. Besides, decrease in the cost of production and transport only affects prices, in the case of a commodity like wheat at any rate, by increasing supplies, and supplies in the United States during the last eight years have been growing smaller, while the population has increased by more than eleven and a half millions. In fact, the American acreage, produce, and exports of wheat have all decreased. As this statement has an important bearing upon the effect of Indian wheat supplies upon prices, it is desirable to show its bases in figures. Below I give the acreage, produce, and exports for the last eight years in two periods of four years each, with the explanation that the exports are for the financial years ending June 30, while the other figures are for the calendar years named :—

AREA, PRODUCE, AND EXPORTS OF WHEAT, UNITED STATES.

Year	Area	Produce	Exports
	Acres	Bushels	Bushels
1880	37,986,717	498,549,868	180,934,478
1881	37,709,020	380,280,090	186,475,251
1882	37,067,194	504,185,470	122,597,997
1883	36,457,593	421,086,160	148,785,696
Total first 4 years	—	1,804,101,588	638,793,422
Average	37,305,131	451,025,397	159,698,355
1884	39,475,885	512,765,000	111,636,302
1885	34,189,246	357,112,000	132,851,835
1886	36,806,184	457,218,000	94,913,395
1887	37,400,000	450,000,000	153,804,929
Total last 4 years	—	1,777,095,000	493,206,461
Average	36,967,804	444,273,750	123,301,615

The exports, it is scarcely necessary to state, are not those from the crops given side by side with them, but in each case from the crop of the preceding year. That of course does not affect my object, which is simply to show the totals and averages for the last eight years, and there are no statistics showing

exports for the calendar years. The figures prove beyond all question that the fall in the price of wheat which has taken place since 1883 is not due to increased production in, or exports from, the United States. Similarly it might be shown that the European supplies have not been materially increased during the last four years, as compared with the previous four, from any other extra-European country besides India. More than this, it might be shown that the total European supplies from extra-European countries besides India during the last four years have been smaller than they were for the preceding four years. A glance at the figures relating to the principal exporting countries suffices to prove this statement; but it would be tedious to go into all the details. It is well known, however, that all but a small proportion of the exports referred to come to the United Kingdom, and it may in a small space be shown that our supplies, without those from India, have been smaller during the past four years than during the previous four.

According to the Statistical Abstract we received wheat and flour, all reckoned as wheat in hundredweights, in the following quantities from extra-European countries besides India:—In the first four years the *United States* sent 175,588,072 cwts., and in the second four, 162,525,858; *Canada* sent 13,288,027 cwts. in the first, and 13,921,025 in the second period; *Australasia*, 13,804,333 and 12,989,661; *Egypt*, 4,028,887 and 1,349,916; and *Chili*, 6,639,276 and 6,591,595. The totals are 213,348,595 cwts. for the first four years, and 197,378,055 for the second. From "other countries," not specified, the totals were only 725,164 cwts. in the first four years, and about 2,031,796 in the second—the latter quantity not being quite certain, as it is necessary to refer to the Board of Trade Returns for the figures relating to 1887, and the "other countries" in that publication do not correspond with those in the Statistical Abstract, which enumerates more countries. If we add these amounts to avoid all question, although they include small quantities from Europe, the totals stand at 214,073,759 and 199,409,851, showing a reduction of 14,663,908 cwts. for the four years ending with 1887, as compared with the total for the four years ending with 1883. If we include imports from the Continent of Europe the drop is greater still. Our receipts from all sources except India during the last four years have been 22,709,805 cwts. (or 5,240,724 qrs.) less than they were during the previous four years. Including India, our imports have been a little over three million quarters less, as we required less foreign wheat, our last four harvests having been greatly superior to the four ending with 1883, every one of which was under average as far as the wheat crop was concerned. Indeed,

they were four "lean years" for Europe as a whole, and, as long as they lasted, the heavy imports, even including those from India, failed to bring down the average price below 41*s.* 7*d.* a quarter; but, in the last four years of generally good or fair wheat crops, the supplies, although diminished, have been relatively too great. If the Indian supply to Europe of about 17,000,000 quarters during the period had not been forthcoming, I believe that the price would have kept above 40*s.* a quarter.

How is it that India has been able to increase her exports of wheat in the face of declining prices, which have reduced the acreage and production of wheat in so great a wheat-growing country as the United States? The answer is very simple. It is that the price of wheat in India has not been reduced at all. Upon that point there is no room for doubt, however much difference of opinion may be called forth in accounting for the fact. Official prices taken from local markets, which best indicate the prices received by growers, will hereafter be referred to; but first it is desirable to show the fluctuations of the prices of a particular standard variety of wheat at a particular place. In the official returns issued by the Indian Government, there are lists of prices at Calcutta and Bombay for certain years, but not for the last two; and as I have been favoured by a large shipping firm with a fortnightly list of the prices of No. 2 Club wheat at Calcutta for the ten years ending with 1885, and for the first half of 1886, and have elsewhere obtained more recent prices, it appears preferable to use these records, which, as they were obtained for commercial purposes, are more likely to be accurate than the official returns. I give below the range of prices per maund of 82 lbs. ($82\frac{1}{15}$ lbs. exactly, but commercially reckoned at 82 lbs.—and conveniently so, as there are exactly 6 maunds of 82 lbs. in a quarter of 492 lbs., the weight at which Indian cargoes are sold in London):—

RANGE OF PRICES FOR NO. 2 CLUB WHEAT AT CALCUTTA.

Year	*Rs.*	*a.*	*p.*		*Rs.*	*a.*	*p.*
1876	2	3	0	to	2	14	0
1877	2	8	0	„	3	11	0
1878	3	4	0	„	3	12	0
1879	3	6	0	„	3	13	0
1880	2	9	0	„	3	7	0
1881	2	8	0	„	2	14	0
1882	2	11	0	„	3	1	0
1883	2	13	0	„	2	14	0
1884	2	3	0	„	2	9	6
1885	2	3	0	„	2	10	0
1886 (half year)	2	7	6	„	2	9	6
1887	2	8	0	„	2	12	0
1888 (Feb.)	2	10	0	„	2	12	0

The prices for 1887 and February 1888 are not in the fortnightly list, but have been supplied by the courtesy of Mr. Klopp, of the firm of Messrs. Kelly & Co., who are extensive shippers of Indian wheat. Mr. Klopp was resident in Calcutta during 1887, and he was the Chairman of the Calcutta Corn and Seed Association, so that his memory as to the general run of prices in that year is not likely to be at fault. The figures show that, although prices were higher in certain years of scarcity than they have been recently, there has been a rise rather than a fall for the end as compared with the beginning of the period, and that the tendency of prices has been generally upwards during the recent years of the greatest expansion of exports. Seeing that the expenses of inland transport have been greatly reduced, as will be presently shown, it may be inferred that the growers of wheat have lately received considerably better prices than they obtained at the beginning of the period.

On the day of my visit to Messrs. Kelly's office, Mr. Klopp had received a telegram stating that No. 2 Club wheat was selling at 2*rs.* 12*a.* per maund, equal to 16*rs.* 8*a.* per quarter, in Calcutta. At the current rate of exchange this was equivalent to about 23*s.* per quarter, and the price in London was only 32*s.* 6*d.*, or not enough to allow the wheat to be bought at the Calcutta quotation, low as the rate of exchange was. Indeed, our prices have for some time been too low for Indian wheat, and very little has been sent during the last few months. Mr. Klopp is of opinion that the ryots can profitably grow wheat to sell in Calcutta at 2 rupees per maund, which is equal to 12 rupees per quarter. The price of the same class of wheat at Cawnpore was 1*r.* 13*a.* per maund at the same date as that above referred to, when 2*rs.* 12*a.* per maund was the price at Calcutta. The distance from Cawnpore to Calcutta is 684 miles, and the rail charge is at the rate of 8½ annas per maund; but there are apparently other expenses, including dealers' profits, to make the difference in the quotations of the two markets up to 15 annas. Mr. Klopp, like all other authorities on India but one whom I have consulted, says that the purchasing power of the rupee is greater than it was some years ago, even in relation to manufactured goods, such as the cotton pieces which the ryot buys for clothing.

Some important evidence upon the points now under consideration was obtained last autumn by the Calcutta branch of the firm of Messrs. Ralli Brothers, the largest buyers of Indian wheat in the world, and I am favoured with permission to publish it. The report, sent to the headquarters of the firm in London, was headed "Comparative Prices of Food Grains in India,

&c.," and is a summary of voluminous statements from all their Indian agencies. The writers state that a long time ago the Calcutta Chamber of Commerce attempted to investigate the subject, and that lately they had been asked by the President of the Chamber, Mr. R. Steel, if they could obtain from the interior such information as was specially wanted by him, owing to a controversy which he had for some time been carrying on with Mr. O'Conor, Assistant-Secretary in the Indian Department of Finance and Commerce; Mr. Steel's contention being that of late years the ryots have obtained better returns from their land than formerly, while Mr. O'Conor held the contrary opinion. Messrs. Ralli add: "The information we have gathered is considered particularly valuable, because it has been gathered from reliable sources, whilst the Government sources of information are in many ways unreliable, and particularly so since the natives who are applied to are very reticent in speaking the truth, because they think it will go against them in being assessed by the Government."

The first question asked was this: "Are prices of food grains of late years higher or lower than they were years ago?" Unfortunately the answer all down the column is merely, "See Lists," and the lists were not sent over from Calcutta. It is obvious, however, from the context that the prices were generally returned as higher in 1887 than formerly. Another question was as to the source of information in each case, and the replies may be summarised as being to the effect that the information was obtained in some cases from the agents' books, in others from their bazaar dealers, and in two or three from official sources, as well as one or other of the two sources already named. The other questions and replies may be given as they stand:—

District	Is the present cost of transport higher or lower than it was years ago?	Does the ryot obtain a better or worse price for his produce than he did years ago?	Over what period does your information extend?
Patna	Lower	Better	1878–87
Sahebgunge	Ditto	Ditto	1872–87
Buscar	Ditto	About same	1879–86
Cawnpore	Higher	Perhaps worse	1876–87
Jubbulpore	Ditto	Probably worse	1866–87
Hurda	About same	Probably better	1882–87
Delhi	Lower	Better	1877–87
Meerut	Ditto	Ditto	"
Nagpore	Cannot say	Ditto	"
Sholapore	Ditto	Ditto	1876–87
Barsi	Ditto	(?)	1877–87
Umritsur	Same	Better	1873–87
Sukkur	About same	Ditto	1877–87
Ferozepore	Ditto	Ditto	1868–87

The following general remarks are appended :—

"Our agents cannot supply accurate information as to the increase in the area under cultivation, and we have not been questioned as to this. We know, however, that the cultivation, chiefly of wheat, has greatly increased, and the conclusion, therefore, to be derived is that of late years ryots must have obtained a better return from their land than previously, which is also mentioned in a general way in some replies. The prices quoted (unfortunately not forthcoming) are naturally those ruling in the central markets, and those obtained by the ryots must be inferred from the information supplied about the cost of transport from the districts. The comparative cost also of production, which, we think, must be in favour of recent over previous years, has not been here touched upon."

The districts from which these reports were received represent all the most important wheat-growing provinces of India, including the Punjab, the North-Western Provinces and Oudh, the Central Provinces, and Bombay. It will be noticed that five of the reports state that the cost of transport has been diminished, while four represent it as the same or about the same, three are doubtful, and two declare it to be higher. With respect to one of the last, I have directly contradictory evidence, which can scarcely be challenged, as far as cost of transport is dependent upon rail rates. The Secretary of the East Indian Railway Company has favoured me with the following comparative statement of rates on his line from three of the most important centres of the wheat trade :—

Rates for Wheat from the under-mentioned Stations to Howrah (Calcutta) during January 1871, 1880, and 1888.

Stations	—	1871			1880			1888		
		Rs.	*a.*	*p.*	*Rs.*	*a.*	*p.*	*Rs.*	*a.*	*p.*
Delhi (miles, 954) . .	per 100 maunds	116	0	0	80	0	0	53	0	0
	per ton . . .	31	9	3	21	12	5	14	6	10
	per quarter .	6	15	10	4	13	2	3	3	1
Cawnpore (miles, 684) .	per 100 maunds	95	0	0	63	0	0	53	0	0
	per ton . . .	25	13	9	17	2	4	14	6	10
	per quarter .	5	11	7	3	12	9	3	3	1
Patna (miles, 332) . .	per 100 maunds	52	0	0	38	0	0	27	0	0
	per ton . . .	14	2	5	10	6	3	7	4	0
	per quarter .	3	2	2	2	4	10	1	9	9

In 1871, the rates were enormous; but they have been reduced until, for 1888, they stand in two cases at less than half the amounts charged in 1871, and in the third case to little more than half. It is clear that there is no rule as to equality of mileage rates on the railway, the charge from Cawnpore being the same at the present time as from Delhi, which is 270 miles further from Howrah, the goods station of Calcutta. The reductions are much beyond the average, having been

brought about by competition with lines serving Bombay; but reductions great or small have been general, and those affecting important centres of the wheat districts have been greatest.

With respect to the replies to the question as to the prices obtained by the ryots, it will be noticed that nine are to the effect that they are better, one that they are probably better, one that they are about the same, one doubtful, and two "perhaps" or "probably" worse. The last two are from the same districts in which the cost of transport is declared to be higher, and one of these has been shown to be mistaken as far as rail rates are concerned. If the price of wheat at Calcutta has gone up rather than down during the last ten years, and the rail rate from Cawnpore has been reduced by more than $3\frac{3}{4}$ rupees per quarter, it is difficult to imagine how the price in that market can be worse than it has been generally since 1871. Possibly the advantage of reduced cost of transport may have been retained by dealers, and not allowed to benefit the ryots, in the districts referred to, and in that case the apparent conflict of evidence may be explained. At any rate, the evidence from ten out of thirteen districts from which a definite reply came is in favour of the ryot having obtained of late a better price for his wheat than he formerly received.

Fortunately we are not left to conjecture as to this question of the course of prices, as they are published annually by the Indian Government, and from some tables showing prices in several districts of the most important provinces for many years past I have worked out the mean prices for each province for 1881, when the export trade first became important, and 1886, the latest year for which the prices are available. The prices are in seers (2 lbs.) per rupee, and it will of course be understood that the fewer seers are given for a rupee the higher the price is.

PRICE OF WHEAT IN SEERS PER RUPEE.

Province	No. of districts	1881	1886
Punjab	13	17·18	17·13
North-Western Provinces . .	12	17·34	16·59
Oudh	3	19·83	19·84
Punjab	6	15·86	19·37
Central Provinces	3	26·55	20·65
Madras	7	12·50	12·90
Bombay	8	13·14	13·81
Mean for these Provinces.	—	17·49	17·18

The prices given are averages for each year, and the figures above represent the mean of these averages for each province.

It will be noticed that the price was higher in 1886 than in 1881 in the three most important wheat provinces—the Punjab, the North-Western Provinces, and the Central Provinces; that it was practically the same in Oudh; and that it was higher for all the provinces together. Yet the price had fallen in England from 45*s*. 4*d*. per quarter in 1881 to 31*s*. in 1886.

Mr. W. J. Harris, who is a high authority upon the question before us, commenting in a letter to the present writer on Messrs. Ralli's returns, says that the cost of transport "evidently means cost of transport from the local place of largest growth to the particular market named, and not transport from that market to Great Britain." I have taken it as meaning transport to Calcutta or some other port from which Messrs. Ralli ship wheat; but it is quite possible that merely local transport may have been in the mind of some of the witnesses. As to the price obtained by the ryot, Mr. Harris remarks: "It evidently refers to the price on the farm, and not to the price at the market town named." He adds: "The whole information goes to prove that, as a general rule, the Indian grower is more satisfied with the prices of to-day in rupees than he was with the prices in rupees eight to fifteen years ago."

Upon this question of prices a gentleman holding a high position in India, whose name I am not at liberty to mention, says that, in consequence of the growth of wheat for export, the staple food of the people in some parts of Northern India has gone up in price from 20 to 25 per cent. since last year, and he gives the following prices, as current in the North-Western Provinces in January 1887 and 1888, in support of his statement:—

PRICES, SEERS (2 lbs.) PER RUPEE.

	January 1887	January 1888
Wheat	16	12
Gram (peas)	26	17
Barley	26	16
Bajra (millet)	20	15
Jouar ,,	21	17
Rice (cheapest sort)	15	10

The authority referred to deems the general rise in the price of food here shown—33 per cent. in the cases of wheat and rice—of grave importance, as showing how entirely the people are dependent upon the character of the year's crops for the prevention of famine. To quote his actual words: "The wheat export trade has withdrawn the stores the people usually kept, and now a bad season brings them at once face to face with famine." Some independent testimony, that of Mr. Klopp, confirms the statement just made as to the exhaustion of the stores of wheat usually kept.

Mr. Klopp, in February last, said that in the districts supplying Calcutta, of which the North-Western Provinces rank as the most important, the supply of last year's wheat was nearly exhausted. Never before had he known the pits in which the ryots store their wheat to be nearly all empty, as they were at that time. Now, although the people do not subsist on wheat to a great extent in ordinary circumstances, they are accustomed to keep a good reserve stock of it as a security against famine, in the event of a failure in the crops of rice and other common kinds of grain. The price of wheat has obviously been high enough to tempt them to throw aside their usual caution, and the dangerous position in which they thus placed themselves raises the question—by no means a new one—whether the export trade in wheat is altogether advantageous to the cultivators.

Messrs. Ralli, in their "general remarks," confidently express the opinion that the growth of wheat in India has increased, at least in the districts embraced by their inquiry. Now we have not long had the advantage of agricultural statistics for India deserving of anything like confidence, and therefore the comparison of the existing wheat area with that of previous years cannot be carried far back. As far as we can be guided by official figures, there is no reason to suppose that any great increase in the wheat area of India as a whole has taken place during the last four or five years. Nevertheless, Messrs. Ralli may be perfectly right in concluding that there has been a great increase in the districts immediately contiguous to the railways, and, indeed, I am assured by other authorities that this is the case. According to the Indian Revenue and Agricultural Department, the "normal area" of wheat in British India is about 26,000,000 acres. In the following table the official estimates of the normal area and the acreage for the last two years are given :—

Province	Normal area	Area in 1886	Area in 1887
	acres	acres	acres
Punjab	7,000,000	6,970,600	5,943,400
North-Western Provinces and Oudh	5,037,000	5,240,381	4,962,942
Central Provinces	4,000,000	3,902,707	4,297,949
Central India	2,500,000	3,500,000	3,500,000
Rajputana	2,500,000	1,500,000	1,562,309
Bombay with Baroda	1,883,000	2,969,539	2,860,454
Bengal (Behar)	1,134,900	850,000	1,009,335
Hyderabad	750,000	1,144,000	1,156,229
Berar	854,000	808,515	933,938
Kashmir	500,000	500,000	500,000
Mysore	20,000	20,000	8,928
Totals	26,178,900	27,405,742	26,735,484

There are some wonderful fluctuations in these acreages, and in such a country as India, where sowing is often prevented, or crops are destroyed, by adverse climatic conditions, great changes in area from one season to another must be expected. The uniformity in respect of two of the provinces is far more suspicious, and must have resulted from very rough estimates being adopted in the absence of precise statistics. It may well be imagined that in an immense country like India, inhabited as it is, the difficulties of the agricultural statistician are very great. No doubt the officials do their best, and, as they have made great improvements of late, we may hope to see Indian statistics made satisfactory in course of time.

The normal yield is supposed by the Department to be about 33,297,000 qrs. In 1885 the crop was estimated at 37,784,000 qrs.; in 1886, at 31,800,000 qrs.; and in 1887, at 29,500,000 qrs. only. From these figures it appears that, during the past two years, the increased exports of wheat from India have been taken from short crops, one of the two being over $3\frac{3}{4}$ million quarters below average. According to the estimate of normal area and produce, it may also be pointed out, the average yield of the Indian wheat crop is not quite 10·1 bushels an acre. In 1886, it appears, the exports amounted to 15·3 per cent. of the crop, and in 1887 to nearly 19·5 per cent.

Attempts to estimate the average cost of producing wheat in India seem to have been generally regarded as hopeless, and this is not surprising, considering the variety of conditions under which the crop is produced in so vast a country. In 1884, the Indian Government gave the estimate of an expert "for what it was worth," and the calculation made by that gentleman was to the effect that, on irrigated and manured land in Northern India, in a district traversed by railways, the cost of production was 12*s.* an acre, the rate of exchange being then 1*s.* 8*d.* for the rupee. The rupee cost would thus be $7\frac{1}{5}$ rupees per quarter. On fair land in the North-Western Provinces so treated the yield would probably be about two quarters per acre, which makes the cost $14\frac{2}{5}$ rupees per acre. The expert referred to further stated that a market rate (obviously meaning a local market rate) of 18*s.* 6*d.* a quarter would probably afford to the producer not more than 15*s.* or 16*s.*—that is, 9 or 9·6 rupees. Thus, according to this authority, a Northern cultivator who manures and irrigates his land gets a moderate profit when wheat sells in a local market at 11 rupees a quarter. If he grows two quarters to the acre, he gets a profit of $3\frac{3}{5}$ to nearly 5 rupees per acre, with the local market price as above stated. Whether the cultivator of "dry" and unmanured land can produce more cheaply or not it is difficult to say. His expenses are much smaller, and his yield

is about half what the grower just taken as an example produces. It is estimated by one of the best agricultural authorities in India that the average produce of the "dry lands" does not exceed 8 bushels per acre. According to the unnamed authority who refers to the extreme prices current for wheat last January, wheat was selling in the North-Western Provinces in January 1886—not to mention the scarcity prices of last January—at 16 seers to the rupee, which is equal to over 15 rupees per quarter.

The Cawnpore price for February 22, given by Mr. Klopp, was equivalent to 11 rupees per quarter; while the Calcutta price of the same date was equal to 16½ rupees. Now, although we cannot tell what is the average cost of producing wheat, we may take it for granted that current prices are remunerative. It is to be borne in mind, however, that 16½ rupees per quarter in Calcutta (2*rs.* 12*a.* per maund) current on February 22, was, according to Mr. Klopp, equivalent to 34*s.* in England, and that the value in England on that date was only 32*s.* 6*d.* Thus the price in Calcutta was about a rupee per quarter too high for shippers to buy without loss. Why there should be a difference of over 5½ rupees per quarter between the price at Cawnpore and that at Calcutta, seeing that the rail rate is less than 3¼ rupees, I am not able to state. There may be some expense for loading and unloading, as well as the dealer's profit; or, possibly, the difference was exceptional on the particular day. There seems little reason to doubt, however, that 11 rupees per quarter at a local market is satisfactory to the grower, and when that is the price at Cawnpore or Delhi, the rail rate being under 3¼ rupees, it would probably be possible to sell at 15 rupees at Calcutta, and that, with exchange at 1*s.* 5*d.* or less, I believe, would allow of the same wheat being sold in London at 32*s.* or 32*s.* 6*d.* with profit.

Writing on the cost of producing wheat in India in his "Statement of the Trade of British India for 1878–79 to 1882–83," Mr. J. E. O'Conor said:—

"In the North-Western Provinces the best estimate that can be made places the cost of cultivation at not less than 15 to 16 rupees an acre (the cultivator's own labour being charged for) on land which is neither manured nor artificially irrigated. If canal irrigation and manure are applied (and manure *must* be applied where such irrigation is given), the cost is increased by at least 6 to 8 rupees per acre. This estimate of 15 to 16 rupees an acre for unmanured and unirrigated land, and about 22 to 24 rupees an acre for manured and irrigated land, may be taken to apply generally to the North-Western Provinces and Oudh, the Punjab, and some parts of the Central Provinces—in fact, to the largest and most important sections of the wheat-producing tracts of India. In the Central Provinces, where irrigation is unknown, the black-cotton soil not requiring it, the cost of production may apparently be taken at not exceeding 16 rupees an acre."

From this statement it appears that, if the ryot charges his own labour, he grows wheat at a loss, as he certainly does not

obtain a return of 15 to 24 rupees per acre, taking dry and irrigated land together.

Representatives of the great Indian wheat-buying firms whom I have consulted, including Messrs. Ralli Brothers, Messrs. Tod, Durant & Co. and Messrs. Kelly & Co., are unanimous in expressing the opinion that the ryots would continue to grow wheat at prices somewhat lower than they are now receiving. Judging from the small increase in the area of the crop, however, since the "normal area" was estimated, they are not very much in love with the wheat-growing industry, and the inference is that any considerable decline in the rupee price would lead to a diminution of production. It is more than a little remarkable to see the area of the crop greatly reduced in provinces so well served by railways as the North-Western Provinces and the Punjab, the two greatest wheat-producing districts of India.

The increased exportation of wheat from India has now, I trust, been sufficiently explained. But how is it that shippers have been able to give enhanced prices for Indian wheat in order to sell it in England at depreciated prices? The mean price for India worked out on a previous page from the official figures for 1881 is equivalent to 14 rupees per quarter, while that for 1886 is equivalent to 14⅓ rupees per quarter. These prices, representing many parts of the interior, are lower than shippers have had to pay at the ports; but if they are proportionate to port prices, the question remains the same. An official return gives the average price in Calcutta in 1881 at 2*rs.* 10*a.* 9*p.* per maund, or 16*rs.* 2*a.* 6*p.* per quarter of 492 lbs. The corresponding price for 1886 is not given in the latest issue of the same return; but it was certainly at least as high. How is it that shippers could give more in 1886, when the average price in England was 45*s.* 4*d.*, than they gave in 1881, when the average price in England was 31*s.*? Or even if, through the reduction of inland rail rates, they paid no more in 1886 at the ports than in 1881, how could they give as much? There is here a reduction of 14*s.* 4*d.* a quarter to make good, independently of any extra cost in rupee price in India.

Freights have been greatly reduced, and in order to ascertain the reduction I applied to Messrs. Angier Brothers, of London, publishers of a freight list, to give me the average steamer freights for certain years, a request with which they courteously complied. They are, I believe, the only persons who could have supplied the information, which is given in the table opposite.

The figures showing the freight per quarter are conversions; the others are those of Messrs. Angier. The reductions since 1880 are 5*s.* a quarter from Bombay and Kurrachee, and 7*s.*

STEAMER FREIGHTS TO THE UNITED KINGDOM FOR WHEAT.

From	Quantity	1871		1880		1881	1886		1888	
		s.	*d.*	*s.*	*d.*	*s.*	*s.*	*d.*	*s.*	*d*
Calcutta . .	20 cwts.	95	0	62	6	60	30	0	30	0
" . .	Per quarter	20	7	13	6	13	6	6	6	6
Bombay . .	16 cwts. to 1887 18 cwts. afterwards	57	6	35	0	40	20	0	18	9
" . .	Per quarter	15	10	9	6	11	5	6	4	6
Kurrachee . .	18 cwts.	—		39	0	45	20	0	18	9
" . . .	Per quarter	—		9	6	11	4	$10\frac{1}{2}$	4	6

from Calcutta. Then the highest reduction between 1881 and 1886 does not make up for half the 14*s.* 4*d.* above alluded to. How the rest of the difference is made up I am unable to show in detail. As the fall in exchange does not account for the whole of it, it is probable that economy has been effected in loading, insurance, and other expenses, besides which there is every reason to believe that shippers' profits have been reduced, while heavy losses have sometimes been incurred, and, I understand, were unusually common in 1886. But, next to the reduction in freights, the greatest saving in the cost of the wheat to shippers was that effected by means of the fall in the gold value of the rupee.

Before entering upon this branch of my subject—and no intelligible account of the Indian wheat trade can be given without discussing it—I must disclaim all intention of advocating Bimetallism, not being by any means convinced of its advantage to this country. My only desire is to state the facts of the case as they are—and, I may add, the conclusions I have arrived at are shared not only by every shipper of Indian wheat whom I have consulted, without exception, but also by some of the staunchest of Monometallists. It will be understood, then, that in showing the effect of the fall in exchange upon the shipment of wheat from India, I in no way commit myself to either side of the currency controversy which has of late been carried on with great intensity.

Unfortunately the details for showing, with any pretence to exactness, the saving in the cost of Indian wheat to shippers caused by the fall in exchange which took place between 1881 and 1886 are not available. The average price of No. 2 Club wheat at Calcutta for many years down to 1885 has been given in the Annual Statements of the Trade of India; but, for some reason, the prices for 1886 and 1887 have not been given in the two latest issues. Prices for 1884 and 1885 in Calcutta and Bombay were lower than they had been in some previous years, and that fact is dwelt upon in the reports in order to show that

the fall in exchange had not been beneficial to India. But in 1886, for certain dates of which prices are available, there was a considerable rise in prices. For instance, in January 1886, the price of No. 1 Soft White in Bombay was 27*rs.* 8*a.* per kandy of 756 lbs., as compared with 22*rs.* 8*a.* in January 1881; and in 1887 the average value of all the wheat exported from India was nearly half a rupee per cwt. higher than in 1886. As nearly as I can make out from the details available, the saving in the cost of wheat to shippers through fall in exchange between 1881 and 1886 was from 3*s.* to 5*s.* a quarter, according to quality and to the period of the year at which the purchase took place.

But in order to show the full effect of the fall in the gold value of the rupee, we must go back much farther than 1881. In 1871–72 the average exchange value of the rupee, as given in the official account of the drawings of the Secretary of State for India, was 1*s.* 11·12*d.*, whereas recently it has been under 1*s.* 5*d.* We shall be on the safe side, then, in taking its fall at 6*d.*, or over 25 per cent. Now, according to a despatch from the Government of India, the price of No. 2 Club wheat in Calcutta in 1872 averaged only 2*rs.* 3*a.* 1*p.* per maund, whereas it has for some time past been over 2*rs.* 10*a.*; but as the price was exceptionally low in 1872, and to simplify the argument, we will take 16 *rs.* per quarter (6 maunds) as the price for both periods, and reckon the exchange value of the rupee at 1*s.* 11*d.* for 1872, and 1*s.* 5*d.* for 1888. At the price named, with the rupee at 1*s.* 11*d.*, the cost of a quarter of wheat was 30*s.* 8*d.*, whereas now, with exchange at 1*s.* 5*d.*, the cost is 22*s.* 8*d.* Here there is a fall of 8*s.* through difference in exchange, while the Indian dealer, and presumably the grower, gets as much as in the earlier year for his wheat. At the time of writing it is only just possible to give 16 rupees (costing 22*s.* 8*d.*) for a quarter of No. 2 Club wheat in Calcutta to sell at market price in England, and it follows that if the rate of exchange were now 1*s.* 11*d.*, as it was in 1872, the shipper could not give more than 12 rupees per quarter in Calcutta at the outside, as the cost would then be 23*s.* Thus the bonus or margin (or whatever least offensive term may be preferred) caused by the fall in exchange since 1872 is fully 4 rupees per quarter on wheat at the price lately current. If wheat of a higher price, such as No. 1 Soft White, in Bombay, had been taken as the example, the saving through fall in exchange would have come out at fully 10*s.* a quarter; but it is desirable to avoid all extreme examples, and a saving of 8*s.* is sufficiently striking. In reality the effect of the fall in exchange has been under-stated, because it affects all expen-

diture on the wheat up to the time of the sailing of the vessel in which it is shipped, including the cost of bags. Mr. Klopp has given the present cost of bags and other expenses incurred in India, making the cost of wheat free on board at Calcutta more than $1\frac{1}{2}$ rupee per quarter above the bazaar price. There is, therefore, fully 9*d.* to add to the 8*s.* above reckoned as the saving effected through the fall in the value of the rupee.

Of course, no one will contend that the shipper could give the rupee price he now pays to sell at the current price in England without the saving due to exchange, and the only question is whether he would be able to buy wheat at a price sufficiently low to enable him to keep up the trade. If he could not give more than 12 rupees per quarter in Calcutta, the price in the local markets, as a rule, would not exceed 7 rupees, and it has been shown that 11 rupees per quarter, in a local market, is the lowest price at which it is supposed that the ryot gets a fair profit on the wheat he produces. That 7 rupees per quarter would be a ruinous price to the ryot under existing conditions, there is little room to doubt. It has been shown that, with prices as they have been lately, the wheat area in India has not greatly increased. Surely, then, it is a fair inference to conclude that it would speedily be reduced if the price fell to the extent above supposed.

Upon this question of the effect of the fall in the gold value of the rupee upon the export of Indian wheat, I have consulted representatives of several of the largest firms of shippers, including Messrs. Ralli, Messrs. Kelly & Co., Messrs. Tod, Durant & Co., and others who did not give me permission to use their names. Without exception, they declare it to be stimulating beyond all question. Indeed, they all declare that the effect is equivalent to a bonus upon export, and that they could not possibly buy at current Indian prices and sell at English prices without the margin obtained through exchange. Mr. W. J. Harris, who is opposed to any interference with the currency as far as India is concerned, lest Russia should profit at the expense of our great dependency, has publicly, as well as privately to me, pronounced the same opinion. Even Mr. W. Fowler, one of the strongest of Monometallists, declared at a recent meeting of the Central Chamber of Agriculture that the fall in exchange was in effect a bonus on the shipment of Indian wheat. Indeed, he used the term "bounty," though the word is open to misconception, and I prefer not to use it. At this meeting of the Central Chamber, I may add, not a single person ventured to deny the conclusion upon which evidence is now being given. Mr. J. A. Parker, formerly editor of the "Indian Daily News," writing upon this point, says: "I am clearly of opinion that

such fall does operate as a bonus to the local (Indian) wheat exporter, and this is borne out by the impetus given to the Indian wheat trade during the period coincident with the decline of the rupee." As to the evidence given before the Royal Commission on Gold and Silver, it would be easy to double the length of this article by giving in full the statements of witnesses—many of them strong Monometallists—to the same effect as the views just stated. Indeed, nearly all the authorities on Indian affairs examined before the Commission supported these three positions: (1) That the rupee price of wheat has not fallen in India in recent years; (2) that the purchasing power of the rupee for all that the ryot needs has not fallen; and (3) that the fall in the gold value of the rupee has stimulated the export of wheat from India.

Those who take an opposite view of this question appear to ignore the fact that the rupee has not declined in value in India for anything that the wheat-grower pays for. If it had declined in value as a standard coin in India, as it has in exchange for the standard coinage of England, there would have been no bonus on the export of Indian wheat. As to that, an objector has said, silver buys as much as formerly in England as well as in India. Perhaps so; but I fail to see how that affects the question at issue. The Indian ryot gets as much for a quarter of wheat as he obtained in 1872. He gets as many rupees, and his rupees are worth as much to him. Can the same be said of the English farmer, who obtained 57*s.* a quarter for his wheat in 1872, as compared with a few pence over 30*s.* now? The present price in India represents as much, if not more, of the world's goods to the ryot as the price in 1872. Does the price in England enable the farmer to pay the rent he paid in 1872, and live as he lived then?

Again, it is contended that if India gets more rupees in exchange for wheat than she would obtain if no fall in exchange had taken place, she receives proportionately less of our manufactured goods in return than would otherwise be supplied. That is true, no doubt; but again I fail to see how it affects the question at issue, which is not whether India is benefited by the fall in exchange, but whether that fall stimulates the export of wheat from India. The English shipper of Indian wheat does not send out manufactured goods with which to buy his grain. He buys rupees with gold, or its representative in paper, and hands over the rupees to the native dealer in exchange for wheat. The transaction is complete in itself, and the amount of goods shipped to India has not the slightest effect upon it. As for the ryot, he does not spend ten rupees a year on English manufactures; and as the goods are cheaper than ever before, it does

not concern him that they would be a little cheaper still if his rupees had not depreciated in English value.

Mr. O'Conor, in one of his reports, contends that, as the export of Indian wheat has not uniformly increased during the whole period of the fall in exchange, the fall cannot have stimulated export. This argument, however, is fully met by a passage in the latest official report on "The Moral and Material Progress of India," in which the origin and progress of the wheat trade is sketched, as follows:—

> "This trade first rose to importance after the repeal of the export duty (3 annas per maund) in 1873. Famines affected the growth of the trade between that date and 1880, but in 1880 81 the exports rose from less than $2\frac{1}{4}$ to $7\frac{1}{2}$ million cwts. A yet greater rise took place in 1881–82, when a conjunction of circumstances, such as a good harvest in India, bad crops, and a 'cornered' market in America, gave Indian wheat a good opportunity, which it accepted. Extended railways and irrigation, reduced rates by rail as well as freights, economy at the ports, and good seasons since 1880, have also naturally contributed much to the development of the trade, and have more than made up for the fall in prices in the European markets, which has only been partially covered by the fall in exchange."

Here the failure of exports for the portion of the period under review, during which they did not increase, is fully accounted for, and it is admitted that the fall in prices has been partially covered by the fall in exchange, which is all that any one claimed in this respect. The average price of wheat in England in 1872 was 57*s.* a quarter, and it is now only a little over 30*s.*, so that the fall in exchange does not account for more than a third[1] of the difference; but it has contributed very appreciably to the total saving which enabled shippers to increase their exports during the last ten years, when the Indian wheat crop, as already shown, was much below average, especially that of 1887, which was not harvested when the passage just quoted was written. Again, Mr. O'Conor, writing in 1886, after two years of low prices, from which there has since been a recovery, says:—

> "Prices in Calcutta and Bombay have not increased; if anything, they have fallen. The cultivator, therefore, has not received from the exporter

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[1] About a third, if the effect of the fall in exchange on wheat "free on board" be taken, instead of the effect on the bazaar price, as given above. Moreover, the proportion of that fall is much greater in relation to the fall in price if we compare the figures for later years than 1872 with those of 1888 For instance, the fall in the English price of wheat since 1875 (and the yearly average has only three times since been higher than it was in that year) is about 15*s.*, and it was not till after 1875 that the rupee fell as low as 1*s.* 10*d.* It was worth quite $5\frac{1}{2}$*d.* more in 1875 than it exchanges for now. Therefore, the difference through exchange on wheat bought at 16 rupees a quarter would be 7*s.* 4*d.*, and on wheat free on board it would be fully 8*s.*, or more than half the fall in price. It will be seen presently that Mr. O'Conor has estimated the fall in exchange at two-thirds of the fall in price down to a certain period.

the increased return which is a stimulus to larger production. Exchange has fallen 20 per cent., which means a gain of 20 per cent. to the exporter; but prices in England have fallen at least 30 per cent. all round, and this means a loss of more than 20 per cent. to the exporter, allowing for the slight fall in prices in Calcutta and Bombay. The exporter, therefore, has not gained directly by the fall in exchange; he has simply been saved from a certain proportion of loss."

Precisely so; the fall in exchange, with economies above referred to, has sufficed to keep the price of wheat from falling in India, comparing the average for the last three years with that for a corresponding earlier period. Mr. O'Conor himself says, in summarising the report just referred to, that "the low rate of exchange has counterbalanced to the extent of about two-thirds (roughly) the disadvantage of low prices in the consuming markets." That is far more than I claim for it. How, then, can it be said that a saving which has kept trade from declining has not stimulated it? The fall in freights by itself has not been sufficient to keep prices from falling in India; yet no one for a moment thinks of denying that the fall in freights has stimulated export.

Then is the Indian wheat-grower benefited by the fall in the gold value of the rupee? That is by no means certain. He is able to put rival growers in other countries at a disadvantage; but he gets only about the same price for his wheat as he obtained when the rupee was at about what is conventionally considered its par value of 2*s*., and any changes which would send it up to par again would almost certainly send the price of wheat up in Europe proportionately, so that he would still get the number of rupees he now receives for a quarter of wheat. By the unequal competition which existing circumstances enable him to carry on he ruins wheat-growers elsewhere, without, apparently, doing himself any good. Indeed, there are authorities in India who contend that it is not to the advantage of the ryot to grow wheat for export at all. Mr. A. K. Connell, who read a suggestive paper on "Indian Railways and Indian Wheat" before the Statistical Society a short time ago, appears to be of this opinion. He contends that the peasantry grow their grain-crops primarily for subsistence, and only to a small extent for sale; that it is only the small surplus over, after supplying the wants of themselves, their labourers, and their cattle, which is affected by market prices; and that the largest part, if not the whole, of that surplus goes to the money-lender. He even appears to suppose that wheat-growing does not pay the ryot, but that the poor man is forced by the money-lender to grow the crop as the best means of obtaining ready money to satisfy his creditor's demands. The cultivator's assessment is raised on account of the alleged increase in the value of his holding, owing

to increased railway communication and the development of the wheat trade, and Mr. Connell gives reasons for doubting whether the stimulus to wheat-production in India is not altogether an unhealthy one as far as the peasantry are concerned. I am not in a position either to endorse or to dispute Mr. Connell's opinion.

Whether, apart from the margin afforded by the fall in the exchange value of the rupee concurrently with the maintenance of its purchasing value in India, the ryot would find it worth his while to compete with the American wheat-grower in the export trade to Europe, is a question which cannot be answered offhand. Under existing circumstances—apart from that of exchange—I am disposed to believe that he would not; but it is by no means certain, or even probable, that the economy of the Indian wheat trade has yet reached its maximum development. It is said that freights cannot be further reduced, because shipping companies have not paid dividends lately; but this is true only with a qualification. It is held by good authorities that while old ships do not pay their owners, with freights as they are, the new and larger vessels pay fairly well. This is especially the case with new steamers, which are now built not only so as to carry a greatly increased quantity of wheat in proportion to the number of the crew in each, but also with improved engines which give a much greater power for a given consumption of coal than the old engines. Again, India, as compared with America, is as yet very poorly served by railways, considerable as the increase in the mileage has been. In 1853 there were only 20½ miles open for traffic; by 1872 the length had increased to 5,555½ miles, and by the end of 1886 to 12,207½ miles. There has since been a further extension, and the Indian Government is now about to borrow a large sum of money for the construction of new lines. As to the rates, instances of great reduction have been given, and in all probability, rather than lose their wheat traffic, the companies, including the State, which owns some of the lines and guarantees or assists the rest, would grant further reductions.

Mr. J. E. O'Conor summed up the possibilities and uncertainties of the Indian wheat trade when he wrote, in the beginning of 1885, as follows:—

"It has been more than once pointed out in these reviews that the trade in Indian wheat must be one of a very uncertain and fluctuating character. Its continuance on a very large scale depends on the concurrence of a number of circumstances: (1) abundant crops in India; (2) crops below the average in the United States and in Europe; (3) low rates of freight; (4) low rates of exchange. When all these exist together the supplies of Indian wheat which will be put on the consuming markets will astonish—as they have astonished—those who are but imperfectly acquainted with the capacity of

India for the production of this grain. When one or other of these fails, the margin of profit, which is so slender at the best that exporters must work on a very extensive scale to obtain appreciable returns, shrinks in such a degree that the export will be carried on either to fulfil engagements already entered into, or as an unavoidable alternative to paying for imports in money."

Elsewhere he discredits some extreme estimates as to the low cost of producing wheat in India, and particularly one to the effect that it was not more than half as much as the cost in America, which he shows to be absurd.

No one can tell what the average cost of producing wheat in either India or America is. The only real tests as to the minimum are those afforded by acreage and exports when prices in Europe are low; and it has already been shown that, judged by those tests, America has admitted that she cannot grow wheat profitably at an average farm price of 65 to 77 cents a bushel, or 21*s.* to 24*s.* 8*d.* a quarter. On the other hand, India has increased her acreage and exports, with the help of low exchange, while the ryots have been receiving something less than 11 rupees a quarter, costing at the present rate of exchange about 15*s.* 6*d.* The expenses of getting the Indian wheat to the coast and across the ocean are much greater than is the case with the American wheat; but we are now considering farm values in English money. How much less than 11 rupees per quarter the ryot has obtained on an average during the last three years no one knows; and it is to be hoped that no one ever will know by means of experience the utmost reduction below that pittance which he will accept and yet continue to grow wheat for export. But in the last "Statement of the Trade of British India" we are told, in reference to the increasing exports of Indian wheat:—

"This advance is not an indication that Indian is displacing American wheat in the English market. The quantity exported to England was nearly 20 per cent. less (in 1886–87) than in 1885–86, and there would have been an actual retrogression in the total exports had not an increased demand from Italy turned the scale. The development of trade was not at the expense of the United States, but of Russia, from which Italy has hitherto drawn regular supplies, &c."

This statement is indisputable as a matter of fact; but yet the inference that India is not a serious rival of the United States would scarcely be admitted by the unfortunate American farmers, who have been driven out of wheat-growing by the low prices, for which Indian competition is mainly accountable. But let us turn to Russia, as the most direct competitor of India. Most opportunely, as this portion of the subject comes to be dealt with, I have received, through the courtesy of the Agricultural Department, a paper on the state of Russian agriculture which begins thus:—

"From recently published Consular Reports it appears that the agriculture of Russia is in a most depressed condition, caused by a continuous fall in the prices of almost all kinds of agricultural produce, and the competition of America and India. Corn-growing has not paid, although the crops generally were good in the years 1886 and 1887. It seems that it costs about 1*l.* 1*s.* per acre to produce a crop of wheat, which is only about $8\frac{1}{2}$ bushels per acre, taking the good and bad land together. The price of wheat was only about 2*s.* 7*d.* per bushel in 1887. . . . As corn-production does not pay, and seems unlikely to pay, the Russian Agricultural Department has been considering carefully the extension of cattle-breeding and rearing, with a view of exporting animals and meat to Western European countries."

One of the reports referred to, previously marked for quotation, is that of Mr. Harford, of the British Embassy, St. Petersburg, who has summarised the final report of the Russian Department of Agriculture for 1886:—

"Next to the United States," he says, the Department "considers India as Russia's most dangerous rival, not only as regards wheat, but for flax and linseed, the imports of which two articles into England from India amounted in 1885 to nearly 3,500,000*l.*"

After referring to the advantages of India, the Russian Department quotes from a recently published work by Dr. J. Wolffe, representing the cost of putting a bushel of wheat on the London market as follows:—

	Indian wheat		American wheat	
	s.	*d.*	*s.*	*d.*
Cost of production	1	$7\frac{1}{2}$	2	6
Carriage by railway	0	9	0	$6\frac{1}{2}$
Sea freight	0	$7\frac{1}{5}$	0	$4\frac{1}{16}$
Totals	2	$11\frac{13}{15}$	3	$4\frac{2}{3}$

These figures are too low, unless they are intended to represent the lowest potential cost, and not the actual cost. Indian wheat has not yet been put on the London market at 24*s.*, and if American has been sold at 27*s.* it has been at a loss to the growers. It may be possible to put Indian wheat on the London market at 24*s.*, if exchange, freights, and railway expenses should continue to fall; but at the present time, as pointed out on a preceding page, a price 8*s.* higher was not remunerative in February of the present year. As to America, sea freights have been lower than Dr. Wolffe states; but it has already been shown that the production of wheat has declined, although as little as 2*s.* 6*d.* a bushel has never had to be accepted as the average farm price.

As bearing upon the point just referred to, it is worth while to reproduce a table prepared for the Gold and Silver Commission by Mr. Comber, member of a firm of Liverpool and Bombay merchants, and a Monometallist, which shows, moreover, if the figures are even approximately correct, how far the reduction in the cost of transport is from accounting for the fall in the price of wheat:—

COST OF TRANSPORT OF WHEAT FROM INTERIOR DEPÔTS IN INDIA AND AMERICA TO UNITED KINGDOM PER QUARTER.

Year	Average price of wheat in United Kingdom	Cost of carriage.—Indian wheat: Inland.—Jubbulpore to Bombay	Cost of carriage.—Indian wheat: Sea.—Bombay to United Kingdom	Cost of carriage.—Indian wheat: Together	Cost of carriage.—American wheat: Inland.—Chicago to New York	Cost of carriage.—American wheat: Sea.—New York to United Kingdom	Cost of carriage.—American wheat: Together	Reduction, compared with 1873, in: Price of wheat	Reduction, compared with 1873, in: Transport from India	Reduction, compared with 1873, in: Transport from America
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1873 . . .	58 8	9 8	13 0	22 8	6 5	7 0	13 5	—	—	—
1874 . . .	55 9	9 7	11 11	21 6	4 8	6 6	11 2	2 11	1 2	2 3
1875 . . .	45 2	6 10	11 4	18 2	3 10	6 0	9 10	13 6	4 6	3 7
1876 . . .	46 2	6 6	10 6	17 0	3 2	5 6	8 8	12 6	5 8	4 9
1877 . . .	56 9	6 7	9 2	15 9	3 9	4 10	8 7	1 11	6 11	4 10
Average of 4 years	51 0	7 4	10 9	18 1	3 10	5 8	9 6	7 8	4 7	3 11
1878 . . .	46 5	6 3	4 10	11 1	3 1	5 0	8 1	12 3	11 7	5 4
1879 . . .	43 10	6 4	6 3	12 7	3 10	4 2	8 0	14 10	10 1	5 5
1880 . . .	44 4	6 4	8 1	14 5	4 1	3 10	7 11	14 4	8 3	5 6
1881 . . .	45 4	6 4	9 2	15 6	2 9	2 10	5 7	13 4	7 2	7 10
1882 . . .	45 1	6 5	6 10	13 3	2 8	2 7	5 3	13 7	9 5	8 2
Average of 5 years	45 0	6 4	7 0	13 4	3 3	3 8	6 11	13 8	9 4	6 6
1883 . . .	41 7	5 8	6 2	11 10	2 10	2 8	5 6	17 1	10 10	7 11
1884 . . .	35 8	5 7	4 3	9 10	2 2	2 4	4 6	23 0	12 10	8 11
1885 . . .	32 10	5 4	4 10	10 2	1 11	2 2	4 1	25 10	12 6	9 4
1886 . . .	31 0	5 1	3 10	8 11	2 11	2 2	5 1	27 8	13 9	8 4
1887, 1st half .	33 11	4 11	4 6	9 5	2 9	1 8	4 5	24 9	13 3	9 0
Average of 4½ years	35 0	5 4	4 9	10 1	2 6	2 2	4 8	23 8	11 7	8 9

In a foot-note to this table it is explained that the cost of transport from the producing districts to Jubbulpore and Chicago is not included in the amounts put down. There is no reason to suppose that the cost of local carriage has decreased in India, as it is chiefly by road; but it has decreased in America on the railways west of Chicago, and allowance for this would bring the reduction on transport from America closer to that on transport from India than it is in the table.

A great deal has been said about the fall in the exchange value of the Russian paper rouble, as calculated to reduce the cost of Russian wheat. Mr. W. J. Harris, writing on February 24, points out that the value of the rouble had gone down to 19¾*d.* (there has been a further reduction since), whereas only four years ago it was nearly 25*d.*, and forty years ago it was 37*d.* That the peasantry of Russia have not felt the full effect of the depreciation may be regarded as certain; but the evidence as to the purchasing power of the paper rouble, compared with what it was four years ago, is not sufficient to warrant any certain conclusion. If the rouble will buy as much as ever of most things that the Russian peasant requires, it goes only half as far as it once went in the payment of taxes, and the Russian peasant is much more heavily taxed than the ryot. At any rate, as the exchange price of the rouble has been falling for years past, that fact was known to the Russian Agricultural Department when (in 1887) the conclusion that wheat-growing in Russia did not pay was declared.

Some remarks upon the advantages and disadvantages of Russia as a wheat-producing country which appeared in the "Miller" last November are well worth quoting:—

> "There is no doubt that the capacities of Russia for cereal production are very great, and our farmers would doubtless have long ago keenly felt the pressure of her competition had it not been for one saving clause. The one thing which has hindered Russia from making the full weight of her great cereal wealth felt in the world has been her own backward economic condition. Russia has an abundance of fertile land, but she lacks railways, elevators, adequate means of maritime transport—in fact, all those 'resources of civilisation' which are so freely commanded by the United States: and these appliances are not created by the ukase of a Czar, they can solely be called into being by civilised brains, and it is in brain-power—in other words, in civilisation—that Russia is hopelessly deficient. No doubt she has all the potentialities for becoming a most formidable competitor in our agricultural markets, but we doubt whether she will be able to make the weight of her arm fully felt until her moujiks have risen a little nearer to the level of the American farmer."

After alluding to the disadvantages incurred by Russia through her exclusive fiscal policy, the writer adds:—

> "Another point is this, that the stronger varieties of Russian wheat are of great value to English millers when they can be obtained at a fair price.

Our own wheats have colour and sweetness, but the weak point of English flour is strength, and that is precisely the quality which Russian grain can supply. So there is indeed a saying in the trade, which was repeated in our hearing by a well-known Metropolitan miller, 'When Russian wheat is cheap the English miller can do well; but when it is scarce, as it has been during the past few years, then come hard times.' A flood of Russian wheat would doubtless be anything but a blessing for this country, but, on the other hand, a free supply at easy prices will be most welcome to our millers."

With respect to other wheat-exporting countries, if India can successfully compete with Russia and the United States, she has no cause to fear any other rival. There are portions of British colonies and other countries in which wheat can be produced as cheaply as in the most favoured districts of the United States; but it has never yet been shown that any of them could send wheat to Europe at a lower price with profit.

The last question to be considered in connection with the Indian wheat trade is whether there is not a natural limit to the quantities of wheat, such as is now produced in India, which Europe will receive. Indian wheat certainly does not improve our bread, much as the bakers like flour made from it, because of the extra quantity of water which it will absorb, and if too much of it were used bread-eaters would rebel. This fact has been more patent than ever since the finer qualities of Indian wheat have come in only very small quantities. Scarcely any No. 1 wheat of any kind has been imported of late, No. 2 Calcutta Club being about the standard quality of the great bulk of our supply. Moreover, the large buyers whom I have consulted, with only one exception, declare that the quality of the wheat sent here from India has, as a whole, deteriorated. But, with respect to the inherent peculiarities of Indian and other wheat, from the miller's point of view, I find the subject so pithily summarised in a passage contained in the "Miller" Prize Essay on "The Mixing of Home and Foreign Wheats for the Use of British and Irish Millers in the Manufacture of Flour," by Mr. W. T. Bates, mill manager to Messrs. Baxendell & Sons, of Liverpool, that I make no apology for quoting the paragraphs in full:—

"The three chief qualities in wheat are, from a general point of view, *strength*, *colour*, and *flavour*. Some few wheats possess all these, but generally one in excess. We shall, however, find it to our advantage to buy these various qualities in separate wheats, and combine them for a standard flour. These different properties are the product of different countries and latitudes, as well as of climate. To the latter, even more than soil, cultivation, and latitude, are due the strongest and best wheats of the earth. We can even classify our wheats, and divide them broadly into qualities, almost according to climate. Thus the strong wheats of America are produced on the elevated prairies, which have a cold, dry winter and a hot, dry summer. Russia, with a similar climate, produces similar wheat; while the seaboard of both countries, being damper, produces a milder, weaker wheat. With a

milder climate we get the autumn-sown winter wheat; and still further south, with a still milder winter, we get the white wheats of California, Australia, Chili, Cape Colony, and others; while Oregon, being damper, yields a similar wheat, but milder and perhaps of better flavour.

"As a rule, the stronger the wheat the less flavour it has, while the milder the wheat the better the flavour. But excessive moisture is, of course, destructive of both qualities, as is also excessive heat and dryness—as witness the desiccated climate of Egypt, which has no moisture but that supplied by the Nile; this seems to be destitute of any good quality. The wheats of India, which are produced under hot conditions, are vastly different from the latter; they have strength and give fairly good results, but their strength is as much a matter of dryness as gluten. The difference between these wheats and the Russian is very marked; while the gluten of the latter is wiry and tenacious, that of the former is harsh and bitter, the result of climate alone.

"The antipodes of this, almost, is the mild, mellow-glutened wheat of England, the produce of our damp, humid climate. This wheat has one, or perhaps two qualities, in which it is unexcelled by any in the world—viz. flavour and colour. If this wheat entered into every mixture, and its flour into every loaf of bread, we should eat our bread and butter with more pleasure than we do now. We have of late years milled strong, dry, water-drinking wheat, not because it made more agreeable bread, or pleased the public taste, but because the bakers, our customers, demanded it. And why? Simply because it enabled them to make a greater number of loaves and larger profits."

For an ideal mixture Mr. Bates gives one part of Duluth, one of No. 1 Spring, one of Australian, and one of fine white English; or, as an alternative, one of Kubanka, one of fine Arymia or Saxonska, one of fine Californian, and two of fine white English. Thus, in his ideal mixtures, Mr. Bates does not include any Indian wheat, from which the inference is that he prefers other sorts for even the qualities in which Indian wheats excel. But when he goes on to give mixtures for various descriptions of trade demands, he does not leave out a fair proportion of Indian wheat.

A great deal has been written about the "dirty" condition of Indian samples, and efforts have been made to remedy this evil, but hitherto without success. It has just been announced that, according to an agreement entered into among the exporting firms of Calcutta, the up-country seller will have a right, as heretofore, to deliver wheat containing five per cent. of foreign substances at contract price, or two per cent. more, subject to equivalent reduction in price; but that if the wheat contains more than seven per cent. of impurity, the dealer will be so mulcted as to make it to his interest to purchase only fairly clean samples. But the great difficulty has been—and there is nothing to show that it has been removed—that buyers of Indian wheat in this country prefer cheap "dirty" wheat to comparatively dear "clean" wheat. The fact is that the "dirt" consists chiefly of various kinds of grain and seeds, which are of some

value when taken out of the wheat, and the cleaning can be done at once more cheaply and more effectually in this country than in India, cheap as labour is in that country, our machinery and workmanship being greatly superior to those of India.

To sum up briefly the evidence which has been reviewed in this article, it appears probable that the Indian wheat trade will continue to expand slowly, with a liability to fluctuations from various causes, such as poor crops in India, low prices in Europe resulting from good crops or heavy importations from America and other countries, alterations in exchange, and temporary advances in freights. The tendency, as we have seen, is towards a still further reduction of the expense of conveying wheat from the interior of India to the coast and across the ocean, and I, for one, believe that prices in Europe have touched the lowest point. But the best authorities appear to be of opinion that, even under the most favourable conditions, the increase of the wheat area in India will not go on rapidly, while, in course of time, the increase in the enormous population will encroach upon the margin of cultivable land at present available for growing grain for export. That a sudden restoration of the rupee to what is termed its par value, through a great discovery of gold, failure in the supplies of silver, or the remonetization of that metal by the principal countries now maintaining a single gold standard, would put a temporary check upon the export of Indian wheat is as certain as anything can be; but then the result of the withdrawal of Indian competition would as surely raise prices in Europe, and thus restore the balance temporarily disturbed. As to the effect of a further fall in the price of wheat in Europe, if that should happen, it may be inferred, from the slow increase in the Indian wheat area under such favourable conditions as have existed during the last two years, that there would be a contraction of the export trade—that is, supposing the fall in price to be greater than could be made up for by a reduction in the expenses of transport. But then, again, the effect here imagined would speedily react upon the producing cause, sending prices in Europe up again.

Thus it appears that, regarding the question from all points of view, the wheat-growers of other countries must be prepared for the continuance of Indian competition on a moderate scale at least, and that their best hope of future profit lies in the conviction that farmers cannot anywhere long keep on growing wheat at a loss, while those who so perfect their economy as to secure the greatest proportionate results from a given outlay will not be among the growers compelled to retire from the too fierce struggle to supply the staple food of the civilised world.

IV.—*Modern Improvements in Corn-Milling Machinery.* By W. Proctor Baker, Broomwell House, Brislington, near Bristol.

It is a matter of common knowledge that within the last ten or twelve years a complete revolution has taken place in the machinery used in this and in other countries for the purpose of grinding wheat when it is intended to produce flour for bread-making purposes; but it is not so well known that with the machinery the system of manufacture has been completely changed. There has been in fact not a mere substitution of one machine for another, or of one series of machines for another series, but there has been a change of the principle and mode of procedure. It has been thought desirable to put a description of the existing general practice on record in the pages of this 'Journal,' more especially as the alteration of the milling process has had a very marked influence in dethroning our home-grown wheats from their former place of preference, and placing them in one of inferiority of value in average seasons as compared with those imported from most foreign countries.

The fact of the comparative depreciation is well known; it is needless to waste space in adducing statistical proofs. It is notorious to all concerned that the new machinery and the new system are not so well adapted for the reduction of native wheats to flour as they are for treating the dryer and harder foreign varieties. If attention be in this place directed to the facts, and to the causes which stand in the way of the more ready use of native wheat in mills possessing equipments of the most recent machinery, it is to be hoped, on the one hand, that mill-owners may be stimulated to adapt their machinery more especially to the manufacture of native wheat, and that the inventive powers of milling engineers may be called upon to second their efforts; while, on the other hand, agriculturists may be led to see the necessity both of producing wheats of a quality and character better adapted than they have hitherto been to the requirements of millers working, as nearly all of them are, under the new systems, and of delivering all wheats in hard dry condition.

It is a great and an additional misfortune for growers of wheat in this country, in times when wheat has to be sold at prices less than the cost of its production, that their corn should be discredited in the markets by the largest buyers, and that its money value in comparison with foreign varieties should be reduced on account of the difficulties of its manufacture into flour. Setting all other interests aside, the importance to the milling trade itself of encouraging the home growth of wheat cannot be exaggerated, for by its use the employment of their

mills and workpeople is assured—home-grown wheat cannot be ground abroad—while they know to their cost that the tendency is more and more marked towards the import of bread-stuffs in the shape of flour ground in foreign mills, in place of wheat requiring to be ground in our home mills.

It is worth while to insert the figures which display this tendency. Taking the cereal years for the period of five years ended in 1880, the imports of flour were 15·9 per cent. of the total imports of wheat and flour; for the five years ended 1885, 23·2 per cent.; for the two years ended 1887, 25·4 per cent.; while for the last four months of the calendar year 1887 they were 31·5 per cent. And these figures may be emphasised by the statement that the average yearly imports of wheat, speaking broadly, have increased but slightly in the last ten or twelve years. It follows, therefore, that, as there is no increase of foreign supplies of wheat, the mills of the country have lost employment annually to the extent involved in grinding the quantity by which the home crop of wheat has diminished, viz., in round numbers, about four millions of quarters. This explains why hundreds of mills in this country are closed.

In order to appreciate the importance of the changes which have occurred, it is necessary briefly to refer to the old process of converting wheat into flour. The first step was to attempt to clean the wheat from impurities, either adhering to the berries in the shape of dust or smut, or such as were mixed with the grain in the shape of chaff, or dust, or lumps of earth, and to separate from it seeds or grains other than those of wheat that were mixed with it. These operations were effected by somewhat primitive machines, designed for use in the period when wheats of home growth formed the staple of the consumption of the mills; and these wheats, thanks to agricultural machinery, the cleanliness of the soil, and the purity of the seed, our farmers were able to deliver in a comparatively clean state. In those times the public were far less critical than they are now as to the quality of the bread they ate, and the existence of a certain dinginess of colour due to the presence of dust and dirt was not remarked, or if remarked was excused, especially in country districts. It was because home-grown wheats were very much cleaner than foreign that they especially monopolised the demand of small country mills, which were not, as a rule, furnished with any cleaning machinery, and thus were not able to deal with the great variety of foul foreign wheats which appeared in the markets. These small mills have now, as a rule, been closed by the competition of the large mills, or, if kept in operation, have had their equipment improved, or are employed in grinding maize, barley, or other feeding-stuffs.

The wheat thus imperfectly cleaned was "fed" into the ordinary millstone, which had in the better mills been improved from a very rough and primitive machine by the elaboration of every part of the apparatus into a very perfect machine, capable in every part of the most accurate adjustment, and lacking in no mechanical refinement. It is unnecessary to describe millstones, as they are, or were, familiar to every one. Suffice it to say that, up to about thirty-five or forty years ago, the object of the miller was to reduce the wheat at one grinding to flour and "offal," and he succeeded best who separated the two elements of the wheat—namely, the flour of the interior of the berry, and the rind or skin—most completely at one grinding.

The "meal" produced by the grinding was then "dressed"—that is, divided by sifting—and ideally perfect work meant that the flour should contain no particle of skin, and the offal or skin should have no particle of flour left upon it. In the language of the mill there must be clean flour and clean offal. No approach, however, to theoretical perfection was ever attained. The flours always contained specks of the skin broken up in the triturating process of millstone-grinding, and the brans or other descriptions of offal were never perfectly free from flour. It was always the aim of the miller to increase the quantity ground per pair of stones per hour, limited by the greater necessity of making "good work" in the way of separation; but in this object he was constantly thwarted by the impossibility of "cleaning the offal" properly, and by the production of too much heat, to the injury of the flour, by the additional friction.

The introduction of "the exhaust"—*i.e.* the withdrawal of the heated air and moisture by a fan from the cases which enclosed the millstones—and of the "blast and exhaust"—a combination of the "exhaust" by one fan, and the "blast" or forcing of air between the surfaces of the millstones by another fan—had for its chief object the increase of the working capacity of the millstone, by keeping down the temperature of the "meal." But whether ventilation was used or not, it was found that increase of the rate of grinding had for one result the production of an intermediate article, neither offal nor flour, composed chiefly of small particles of the hardest portion of the farinaceous part of the wheat-corn, either alone or attached to a minute particle of the skin. These particles, mixed with particles of the skin of the same size, were the product termed "middlings."

"Middlings" were simply particles of the wheat imperfectly ground, and were reduced to flour by regrinding on a separate pair of millstones. The resultant flour, if the middlings were tolerably free from particles of bran, was found to be better than the flour of the original wheat-grinding, as was natural, because

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the "middlings" consisted of the hardest and best part of the wheat. The difficulty was, however, the admixture with the "middlings" of the chips of bran, and it was not until about fourteen years ago that machines were brought into general use for "purifying" the "middlings." Up to that time it was sought to make as small a percentage of "middlings" as possible. Since the invention of the "middlings purifier," which enabled the miller to obtain pure middlings, from which he could make flour better than that coming from the original grinding of the wheat, the aim has been to make as large a percentage of middlings as possible. And this principle of making middlings instead of flour is the basis of the new "gradual-reduction" system, the system now in vogue.

One point or note of good grinding was the detachment of the bran in large unbroken flakes, because the flour was more likely to be pure than it would be if the bran were "cut up." The skin or bran of wheat is more or less brittle, according to the variety of the wheat, if the grain be in equal condition. It may be laid down as a rule that the dryer and harder the wheat the more brittle the bran; and it follows that the more brittle the bran the more apt it is to break up into small particles, which, passing through the same fine meshes of the sifting medium as the flour, are inextricably incorporated with it. It ought to be noted here that it is by no means only in the appearance of the flour that the mischief resulting from the presence of minute particles of bran exists. That, commercially, is perhaps the least evil; for if the particles be very minute they are not so readily perceptible as might be expected. It is especially when the flour has been made into bread that the discolouration caused by these particles manifests itself. It has been shown that they cause a secondary and destructive fermentation, and that the discolouration of the bread is due not only to the dark colour of the particles themselves, but to their discolouring effect upon the flour with which they are mixed. Thus bread made from flour mixed with bran is, in appearance, a bread not like bread made from the same flour with flakes of bran in it, but the whole body of the loaf is stained, and browner than that made from flour without bran. Hence, as the colour of the loaf is the principal test of the good quality of the flour, the importance of keeping the bran unbroken, and therefore it follows that millers would give the preference to wheats which, all other things being equal, had the toughest skins, because the skins would be less likely to cut up.

English wheats, in fairly dry condition, gave, because of the comparative toughness of the skin and the softness of the berry, which permitted the reduction of the farinaceous portion to

flour with a minimum of friction under the millstone, the best results in unbroken bran and purity of flour, and thus, for this and for other reasons, were sought for at a price relatively high compared with their foreign rivals. These latter were, indeed, regarded as only supplementary or as substitutes for native wheats, which supplied the staple consumption of the mill; they were used chiefly in order to give "strength" to the flour.[1] In those days the mills were generally situated in the rural districts, and drew their supplies from their immediate neighbourhood. Now, however, the great mills that supply the country are placed either at the seaports, or in the midst of the great centres of population, or, unfortunately for the interests of this country, in America.

The "meal" delivered by the millstones was, after having been cooled, conveyed to the "dressing-machines," the term applied to the machines by which the flour was separated from the "offal." In very old mills these machines were "bolters," in which the sifting was accomplished by means of a woollen cloth; later, "wire machines" were adopted. These consisted of a fixed or slowly rotating cylinder of wooden hoops or ribs, covered with woven wire cloth and inclined at an angle, having running through its centre a spindle furnished with arms or spokes, to which were affixed brushes arranged so as to be in contact with the wire cloth. The spindle was made to rotate at a high velocity, and the meal having been introduced at the higher end, or head of the cylinder, the flour was forced by the brushes through the meshes of the wire cloth, and the offal passed out at the lower end, or tail of the cylinder.

About forty years ago "silk machines" were first introduced in England. The operative part of the machine was a "reel," a long hexagon frame made of laths and covered with silk cloth. The "reel" was carried by arms on a central spindle, and caused to revolve just so fast as to lift the meal, which was fed into the head end (the "reel" being arranged with a slight fall from "head" to "tail"), to the upper side of the "reel," whence it fell on the silk surface on the lower sides, and thus the flour was sifted out, the "offals" passing out at the tail. This machine gave a purer or cleaner flour than the wire machine, because the brushes of the latter forced the small particles of bran through the wire cloth; while under the more gentle action of the silk-covered "reel" the particles of skin being lighter than the

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[1] The quality of "strength" in flour depends on the presence of a large proportion of elastic gluten in the wheat from which it is made, and it is so named because the flour possessing it yields a tough dough which rises in the oven into a large loaf. English wheats lack this quality, and are classed as "weak" wheats.

particles of flour, and not being forced through the meshes, passed on to and out of the tail of the machine. The silk reel was especially efficient in separating the "middlings" (already described) for regrinding. The flour having been obtained, the "offals," whether from wire or silk machine, were generally rebrushed in another wire machine and separated into "bran," "sharps," or other subdivisions, according to the custom or demands of the district. And thus ended this comparatively simple process, which, with various slight modifications, more especially connected with the production of middlings, their purification, and reduction to flour, was that in general use in this country up to about twelve years ago. It was well adapted for the manufacture of native wheats, and if these had continued to form the larger part of the supply of the country, it is possible that the revolution in the art of milling which has taken place might have been slower in realisation or might have taken another direction.

But, however that may be, the system now generally adopted is based on different principles. It is called "gradual reduction," a name which well describes the process. While the old "low-grinding" system was seen at its best in working upon soft tender wheats, the "gradual-reduction" process requires dry and rather hard wheats to make good work. Its adoption in this country was contemporaneous with the introduction of "roller mills" as substitutes for millstones. The system was practised on the Continent long before rollers were brought into use; but the drawbacks of the system, when millstones and tender wheat were used, were so great that it was practically confined to districts where the produce of the country was hard wheat. Hungary undoubtedly took the lead and developed the system most completely, and succeeded in producing from her harsh, brittle, brown wheats flours of unrivalled quality, while the same wheats when treated by "low-grinding" gave wretched results. The North-West States of America produced wheats of very similar character to the Hungarian wheats, and the Americans, by treating these wheats in a similar manner, achieved a great commercial success, as evidenced by the creation of the enormous mills of Minneapolis, worthy rivals of those of Budapest. The advance in the value of the wheat grown in the North-West by the millers' adaptation of the Hungarian process is enormous. A few years ago the hard spring wheats of this region were worth from 3*s*. to 13*s*. per quarter less than fine winter wheat of the more eastern States, while for several years past this very same good hard spring wheat has ranked higher in value than fine winter wheat. As wheat is the pioneer and main crop of the North-West, the adoption of the

new system of milling has therefore as much as anything rendered the development of these regions possible and profitable by largely increasing the prices paid for their wheat crops.

Here, then, are two conspicuous instances of the fact that if the colouring cells of the bran and the germ be excluded from flour, the flours made from dark red wheats may, and do, produce bread better in colour than that obtained from the finest white wheats, if the constituents of the wheat are in other respects better—and the constituents of the wheats just mentioned are better because they contain a higher proportion of elastic gluten than any known white wheats. As already noted, colour of bread, other things being equal, is the commercial test by which the value of flour is assessed. It is because by the "gradual-reduction" process the bran is absolutely excluded from certain portions of the flour that these flours of red wheats, containing a very high proportion of gluten, exceed considerably in value flours made from the finest white wheats. The colour of wheat, therefore, no longer affords any guide or index of the colour of bread made from its flour.

English white wheats no longer command the large premiums which were formerly paid for them over and above the prices of red wheats. The difference was paid, when they were ground under the old system, chiefly because the bran of white wheat discoloured bread very much less than the bran of red wheat. When the bran of neither is mingled with the flour, the difference in value to the miller of the two sorts on the ground of colour nearly vanishes. So with regard to English and other mellow red wheats. They formerly fetched much higher prices than harsh wheats, because the brans were less brittle, and less liable to break up and discolour the flour. Yet now that the difference in value on that account no longer exists, for other reasons which will hereafter appear, mellow or tender wheats, except they be in the finest condition (which, unfortunately, native wheats not often are in the winter-time, when the bulk of them come to market), are at a discount compared with wheats of firmer texture. Reference is here more particularly had to the physical structure, as influencing value, rather than to the chemical elements. And it must also be noted that even with the most improved machinery and systems it is not possible absolutely to separate all the bran from the flour. Some of the finest flours may be, and are, perfectly free from bran contamination, but the lower grades of flour still contain particles of the wheat skin. The art of milling has not attained anything approaching to perfect theoretical separation, even when applied to wheats the physical construction of which lends itself best to the means employed. So that, other things being

equal, those wheats that have the least friable skins are better suited for the modern miller's use, even when he is equipped with machinery of the most recent type.

The broad distinction between the "gradual-reduction" system and the old "low-grinding" system is that, whatever the machinery employed, it is sought in "gradual reduction" to break the internal farinaceous part of the wheat-corn into gritty fragments, like coarse sand, keeping the bran as much intact and scraping it as clean as possible, and to produce as little flour as possible in the initial processes; while in the old system, as has been described, it was desired to make all the interior of the wheat into flour at the first grinding. The object of avoiding the production of flour is this: whichever process be used the bran will break up to some extent—this breakage cannot be avoided—and it will break or be cut into some fragments among others so minute, that in the process of sifting, these minute particles of bran can, and do, pass through the same fine meshes of the sifting medium as the flour particles. If once they be mixed with the flour there is no possibility of again separating them, and the flour is thus spoiled.

In any form of gradual reduction, and from any wheats, a certain small percentage of flour must be made in breaking down the wheat, and that portion of the flour is injured by the particles of bran that pass through the meshes of the sifting apparatus and are mingled with it. The bulk of the interior of the corn is, however, obtained in gritty fragments, with which are found small bits of bran of the same size. These fragments, named "semolina" or "middlings," are submitted to a "purifying" process, by which it is possible, more or less completely, by the application of wind currents, either alone or in combination with sieves, to separate from the "semolina" or "middlings" the bits of bran, they being of lighter specific gravity. It is obvious that (theoretically) if the bran particles be sucked, or sifted, or blown away, there will remain pure farinaceous fragments free from bran, and that these may by any appropriate grinding or crushing process be reduced to a pure flour. This is, in effect, what is done in the "gradual-reduction" process.

Difficulties, however, arise at every stage, and the process, while simple in principle, is very complicated when brought to the test of practical application. For instance, to avoid waste of flour, it is needful that every particle of it should be scraped off the bran; but the bran is not readily detachable from the internal parts of the kernel of the wheat, and, in breaking down the corn, fragments of the interior are always obtained with pieces of bran attached to them. These fragments of farina-

ceous matter united with bran are commingled with the purer "semolina," and if all were ground together the impurity caused by the presence of bran would still enter the flour. It is therefore necessary, still by air currents, to separate this branny "semolina" from the pure "semolina," and by breaking down the former separately to detach the bran from the pure flour-bearing cells. These latter may then be dealt with in the same way as the pure "semolina."

There is also the germ of the wheat to be excluded from the flour. This is, from the miller's point of view, yellow, moist, oily matter, to be rigidly separated from the flour. It is sought to detach the germs in breaking down the wheat as far as possible unbroken, and then by sifting and the use of wind currents to concentrate them in one or more divisions of the "semolina"; these are passed through rollers with smooth surfaces, by which the germ is flattened into flakes, while the "semolina" is reduced to powder, and the germ is then easily separated by sifting. These are but examples of the difficulties met with. The final product obtained is in the shape of flours of various grades of purity, according to the material and place in the process from which they come, and the offals.

The principles on which the old and new systems of milling are based having been thus sketched, it is proposed to describe somewhat generally the modern mill and the machinery to be found in it. Among other changes that have occurred, perhaps one of the most marked is in the size of mills. Under the old system it was quite possible that a mill of very small capacity could be as efficient in proportion to its size as the larger mills. The larger mills contained only a repetition of the apparatus to be found in the smaller mills. But in "gradual-reduction" mills the work branches off into so many divisions and subdivisions of the products, that a large number of machines has to be provided each for a distinct employment, and for the full employment of each machine a certain minimum quantity of material is required. In large mills the provision both of material and feed is easy; but in small mills both the room is lacking for the machinery, and the quantity of material to be manufactured would not provide sufficient work for the subordinate machines even if they were present. It may perhaps be laid down that approximately 50 bushels per hour is the least quantity that can be dealt with properly when working continuously in a thoroughly well equipped mill; while, in the millstone process, mills grinding as little as 6 or 8 bushels per hour did good work. The largest of the gigantic American mills is designed for grinding about 1,300 bushels per hour; but very few separate mill plants in this country exceed a capacity of 200

bushels per hour. The tendency is very marked in the direction of the construction of large mills, and very small mills are going out of use. The number of mills in the country now running is far less than it was ten years ago. The decrease has been chiefly in small mills in country districts.

Steam has very generally superseded water as a motor, on account of its constancy in work and the freedom it allows in choice of a site; also from the consideration that the cost of conveyance to and from a water-mill generally exceeds, except in a few rare situations, the economy of water over steam. In most water-mills steam-engines are now provided for use in short-water or flood times. The modern mill is substantially built, and generally of a considerable height, as the best arrangements of machinery demand floors of from 14 to 18 feet from floor to ceiling. Instead of all the work being carried on in one building, a wheat store, a department for cleaning wheat, a mill in which the grinding operations are conducted, and a warehouse to receive and store the finished products, form the block. These should all be divided by complete walls from ground to roof, so as to limit the spread of fire. The cost of insuring mills and their contents is very heavy, and that of insuring stores comparatively light, so that it is good practice to allow no material except what is in actual process of manufacture to remain in the machinery departments. It may be premised that from the moment the wheat is brought within the wheat store or mill building, throughout the cleaning and grinding processes, and until the products are packed in the sacks for delivery to consumers, all the material, in whatever form, is moved from place to place by mechanical means, and nothing should be moved by hand-labour.

The means of transport in a horizontal direction or for moderate inclinations are "band conveyors" and "endless screws or worms." Band conveyors are belts, generally of india-rubber, running over terminal pulleys at a considerable velocity supported on intermediate rollers. The grain or material to be conveyed is fed in a continuous stream from a pipe, which deposits it on the upper surface of the belt, where it lies with very little disturbance, notwithstanding the high speed at which the belt travels, and is carried to the desired point of delivery. At that point the band is deflected sharply downwards over a pulley, and the grain or other matter continuing in the same path is shot forward by its own impetus, and may be caught in any receptacle, or may be "shunted" to a band running in a direction other than that of the first. For long distances this is by far the most economical mode of conveyance. "Worms" or "screws," of various diameters from two inches upwards, by their

revolution in a box or case force the material forward in the desired direction, and are convenient for short lengths, and are specially useful in any position where, as often happens, matters of different sorts require to be thoroughly mixed during conveyance. "Creepers," consisting of strips of wood fastened to an endless band, are sometimes used, and operate by dragging the stuff to be moved along the bottom of the box or casing in which the creeper runs.

For lifting purposes "elevators" are employed. They consist of endless belts, furnished at short intervals with cups of hide, or tinplate, or iron, or steel, running in vertical, or nearly vertical, cases or pipes, either rectangular or round, of wood, or iron, or steel, over pulleys at the top and bottom extremities. The material to be elevated is fed into the box or "boot" enclosing the lower pulley, where the cups or buckets fill themselves by scooping into the mass or stream, and ascend to the top and pass over the pulley, driven at a velocity which is regulated so that they may throw out their contents in a nearly horizontal direction into some receptacle, and clear of the case by which the belt and cups descend. Endless worms rapidly revolving in stationary iron cases, which fit them nearly closely, are also used as vertical elevators. It is requisite that the feed should be forced into these worm elevators at the lower end. They are more expensive than the band and cup arrangement, but occupy little space, and would not act as so many flues, as would the cases of the ordinary elevators, in the event of fire. Combinations of these conveyors and elevators with connecting pipes through which the "stuff" descends by gravity are employed to carry the material to and from the various machines. These connecting pipes may be of wood or metal, and in the case of grain, when the stream runs at any considerable velocity, the pipe must be of wrought or cast iron or steel in order to resist the wear. A stream of wheat constantly running will cut through a wooden pipe in a very short time. When wooden pipes are used they should be lined with iron. Sheet india-rubber is also said to resist the wear.

In granaries and mills it is necessary to weigh the material at various stages, for many reasons. These weighings are performed by "automatic scales," which weigh with the utmost accuracy a fixed load, cut off the supply with great delicacy and certainty, discharge the load when weighed, and record the number of weighings. By the employment of these machines, a check and control of the work of the mill at all points can be well and cheaply sustained. As mill-buildings are very high, and rapid communication from one part to another is a necessity, the best modern mills have fast-running lifts, by which

foremen and workmen can ascend or descend to any desired floor with great rapidity. A modern mill should be well ventilated by exhaust-fans, and the dust of the old-fashioned mill should not be visible. In fact, dust is never allowed to escape in a well-cared-for mill, and the utmost cleanliness is observed, as a prevention of waste and as one of the most important precautions against fire, accumulations of dust being not only wasteful but highly dangerous.

Fire is, in fact, a source of anxiety and terror to a mill-owner, and there is no doubt that for a few years after the introduction of the new system the want of knowledge of sources of danger, arising chiefly from the multiplication of machinery and the lack of sufficient care in watching the many points where friction may produce heat, exposed corn-mills to the suspicion of being very risky buildings, as a large proportion of fires did take place. Yet if a corn-mill be carefully designed, and well looked after, there is no reason why its machinery should be dangerous. Mills should, however, be well provided with fire-extinguishing appliances; hand apparatus, buckets, fire mains, and hose reaching every part of the building should be available on every floor, and recently automatic sprinkling arrangements have been contrived, by which a shower of water may be discharged on any spot when sufficient heat is developed to melt a metal alloy plug fusible at a comparatively low temperature. The electric light is of great advantage to corn-mills, as they almost invariably are kept in operation by night as well as by day.

An idea having thus been gained of the general condition and appliances of recently constructed mills, the machinery in them may be more particularly described. To commence with the wheat-cleaning machinery. In the present day this has to be arranged and adapted so as to deal efficiently with wheats of all descriptions produced in all wheat-exporting countries of the world. For English wheat alone very simple appliances are sufficient. If seeds be found among the wheat, they are usually small and easily removed by sifting-machines, and slight friction detaches from the corn any chaff, which may then be removed by winnowing. Smut is more difficult to deal with, as however carefully the sifting or winnowing process may be conducted, either then or previously in thrashing a certain number of smut balls, if they are present, will have been broken, and will discolour the wheat, especially at the hairy or "fuzzy" end. There are "smutters"—a generic name applied to all machines that clean wheat by friction, a name used when native wheats were chiefly employed, and when smut was more prevalent than it is now—which will scrub off all this smut, if not by one passage through the machine, at any rate by a second; and there are "smutters"

that will not remove the black contamination: and although it is used for getting rid of all sorts of dust and dirt, its efficiency in the treatment of smut is one of the tests of a good "smutter."

Probably the most trying difficulty in native wheat is the presence of garlic. Grains of garlic are so nearly of the same size and weight as a large proportion of the grains of wheat that it is not possible to separate them. Thus the garlic passes on to the grinding machinery, and produces terribly bad effects, for the sticky tough contents of the grain smear and plaster over the cutting or grinding surfaces, whether of millstones or rollers, and thus effectually blunt them, and at the same time impregnate the whole mill with the vile familiar stink. The loss arising from this blunting is very serious, and it is surprising how mischievous is the result of the admixture of only so few of the garlic grains as will escape detection among the wheat. No machine has yet been invented which can be relied upon to make a complete separation. Garlic is avoided by the owners of large mills like the plague, and no trouble should be spared by the occupier of garlic-bearing land in eradicating the pest. In the old small mills wheat mixed with garlic was ground on separate millstones, to which the mischief was confined.

With regard to wheats of foreign origin, it would be difficult to construct an exhaustive list of the impurities, or of the seeds, grains, or pulse mixed with them. It may be said generally that dust, lumps of mud, stones, sand, mouse and rat droppings, worms, weevils, beetles, larvæ of insects, grains seeds and pulse of all sorts, pieces of wood and iron, twigs, rope, twine, wire, pieces of sacking bagging or matting, straw and chaff, are the most frequent articles to be met with. There is, moreover, a certain proportion of shrivelled or diseased wheat, and the shells of wheat-corns of which the interiors have been eaten by weevil, and in Californian wheats many broken corns.

These foreign wheats are purchased and delivered in large parcels, and the better practice is first to free them from such impurities as can be removed when the wheat is handled in large masses—in short, to subject them to a preliminary cleaning before they are deposited in the mill granary. In order to do the work rapidly, this rough process, by which it is sought to remove all matters that are distinctly larger than the largest of the wheat-corns and smaller than the smallest, must be carried on by machines of very large capacity (some doing as much as 1,000 bushels per hour each), and the streams or layers of wheat in passing these machines must necessarily be somewhat thick. In the more delicate and accurate cleaning which will follow, it is necessary that the wheat should be spread in thin streams, so that each corn may be acted upon, and thus

the working capacity of these latter machines is much smaller. This roughly cleaned wheat is then conveyed to the granary, which for the economical handling of the wheat should be constructed so as to contain a series of vertical bins or cells, hopper-bottomed; from these it may be drawn as and when required for use in the mill.

Before being ground, the wheat must undergo a more thorough purification from extraneous matters and be subjected to a scouring process. It is easy to imagine that if the wheat be passed in a thin stream over sieves with the meshes or holes so arranged that the wheat may just pass through, all matters larger than the wheat will be rejected; and then if this wheat be passed over another such sieve with holes arranged so as not to allow any wheat to pass them, all dust, sand, and small things would be removed. If then the wheat be exposed to a current of air, all defective corns, or things which are of the same size as but lighter than wheat, can be sucked or blown away. But it will be apparent that the holes in the coarse sieve must be larger, while those in the fine sieve must be smaller respectively than the smaller diameter of the wheat-corns, and consequently many things which are nearly of the same size and weight as the wheat-corns may pass with the wheat. Among such things are stones, bits of mud, barley, oats, rye, pease, vetches, and cockles, and the problem is how to get rid of them.

For this purpose, machines are used in the operation of which the length of the wheat and other corns as distinguished from those that are round is brought into play. The machines adopted for this purpose have for their principal member a metal cylinder, the smooth surface of which, whether on the interior or exterior, is pitted with hemispherical recesses of a diameter about corresponding with the small diameter of a wheat-corn. It is arranged that the stream of wheat shall be repeatedly brought into contact with the surface of the cylinder, which is made to revolve slowly; in the holes all the round seeds or other matters lodge, and are carried up by the revolution of the cylinder to a point where they roll or fall out, and as they fall are intercepted by an arrangement which carries them out of the machine at a point separate from that at which the wheat is discharged. But as the wheat-corns would also enter these holes endwise and project, a light scraper is applied to the "pitted" surface, which knocks these corns out and they fall back to the stream of wheat. By changing the size of the holes the wheat may be picked up, and oats, barley, straws, or such-like things left behind. A variation of detail enables the operator to separate almost everything from the wheat. In this department of cleaning machinery, very little remains to

be desired, as wheat can be thoroughly cleaned, with scarcely any waste of good wheat.

The wheat thus freed from other matters will still have dirt attached to the skin, some dust among it, and pieces of mud that have escaped separation on account of being nearly the same size as the wheat, and occasionally stones. These stones are present in wheats that have been thrashed either by flail or by treading out on a thrashing-floor on the ground, and are picked up with the corn. To detach and remove the dirt and dust, to remove rough particles of the epidermis, and to break up the particles of mud, the wheat is subjected to strong friction. It is desirable, so far as possible, to remove the hairy beard and the loose skin which covers the germ, and any other wrinkled parts of the skin where dust may lodge—in fact, to polish each corn. The variety of machines constructed for these purposes is great, as well as the materials and form of the operative parts.

The great distinction of the machines is in the difference between the application of rough and rasping surfaces and smooth surfaces; and in the latter class of machines, between those which accomplish the purpose by a beating action, and those which attain the object by causing a friction of the grains among themselves. For the purpose of polishing the grain and keeping the skin as far as possible unbroken, the latter class is to be preferred, and those having a rasping or grating action are to be avoided. The casings of nearly all these machines are constructed of perforated metal or woven wire, and no machine is perfect in which the dust produced and the pieces of skin detached are not at once separated from the wheat and carried away by air currents to the dust-room. When wheats are very dirty or the skins very rough, it is sometimes needful to pass them through two or even three such machines in succession. It must be confessed, however, that there is room for improvement in this class of machines, especially for those intended for use in this country, where wheats of great dissimilarity have to be used, requiring means (which do not exist) of regulating the intensity of the frictional process. Finally the wheat is to be passed through a brushing-machine, in which, while the wheat is turned over in all directions, it is scrubbed by a brush so as to remove any dust or particle of skin that may still be lodged in the crevices of the corns. The wheat emerges from this series of machines with a smooth polished coat, so that when handled it is slippery to the touch and bright and glistening to the eye, instead of being in the normal state of roughness and dulness.

But there are varieties of wheat in which the dust and dirt are so intermingled with the grain, and the mud is so stubborn,

that they cannot be removed by the process just described. Such, for instance, are the Indian and Egyptian wheats. These wheats require thorough washing in order to dissolve the mud-clots and to free the grain from the attached dirt. Mingled with these wheats stones are frequently found. There are several types of washing-machines; the best of them, in addition to active agitation of the wheat in water, are so contrived as to provide an upward current of water (into which the stream of wheat is directed) of sufficient force to carry the wheat with it to another part of the machine, and not so strong as to lift the heavier stones, which drop to a receptacle provided for them at the bottom, and thus a complete separation is effected. The wheat having been washed is allowed to drain, and is then passed into a centrifugal drying machine. This throws off much of the water, but does not dry the wheat sufficiently for immediate grinding. Some apply jets of steam to the wheat in the centrifugal drying-machine, with the object of driving out of the crevices any dirt that may have escaped the washing process. But in any case, if it be desired to grind the wheat within a short time, a dryer employing artificial heat must be used. It remains to be mentioned that no mode has been indicated of removing stones from wheat if the wheat be not washed. There are machines contrived, and extensively used, for the purpose, but none of them are perfectly effectual.

From what has been said it may be conceived how great are the difficulties which millers have in cleaning and purifying foreign wheats, and how great ingenuity has been put in action and how much outlay incurred in overcoming these difficulties. In this respect our native wheats stand at a great advantage, as they are delivered almost clean to the mills, and do not call for the use of this elaborate machinery. It is to be feared that millers do not estimate at a sufficiently high rate the losses they sustain by the stuff separated or lost in the cleaning process. Some foreign wheats are so foul that to clean them, and even then imperfectly, a removal of ten per cent. or more of the original weight is necessary. In order that the miller may know what his loss is, wheat should be weighed after cleaning, and the weight compared with the original; its use at this point affords a good instance of the usefulness of the automatic weighing-machine.

The wheat thus cleaned and purified may pass from the cleaning department into the mill. It will have been seen that native wheats, so far as their mechanical treatment in the cleaning process is concerned, should be preferred to foreign sorts. It is not proposed in this paper to deal with the question of the extent to which the comparative value of English wheat is

affected by its chemical composition or by the baking properties of flour made from it. It is desired to show its advantages and disadvantages from the mechanical point of view, and this seems to be the most convenient place to state in detail the difficulties of manufacturing it into flour, for it is in the modern milling process which is now to be described that the difficulties occur. The great drawbacks are the softness and looseness of texture of the endosperm, the farinaceous part of the corn, the large proportion of moisture which the grain holds, and the property which native wheat possesses, even if it be delivered in "good condition" and be stored in a well-protected warehouse, of absorbing moisture from the atmosphere.

The largest proportion of the wheat-crop is now marketed in the damp winter months, and in those months consequently when wheat is in its worst condition. Immediately after a dry, hot harvest-time wheat is in as good condition as at any time, and also in the spring and early summer after it has been exposed in rick to the influence of the drying March winds. But in winter the condition varies very much and very rapidly with changes of weather, and a decline in price of English wheat is often recorded "owing to poor condition," when there is no change in the actual position of the market. Nor can English wheat be stored in bulk for any long period without risk of deterioration. Absolute dryness and firmness of texture as opposed to toughness in any or however slight a degree is far more important in the "gradual-reduction" process than it was in the days of millstone-grinding, and for the reason that the millstone accomplished its work by a combination of crushing, tearing, and rubbing of a prolonged and violent kind, and thus was able to detach from the bran the floury particles of the grain in the shape of flour mixed with particles of bran, while in roller-milling it must be remembered that the object is to break the interior of the wheat into gritty particles and not into flour.

The grooved roller-mills work with comparatively little pressure, and the grain is subjected to a cutting action of very short duration. The smooth rollers subsequently reduce the gritty particles to flour by a crushing and rubbing action of a far gentler and less prolonged kind than that exercised by the millstone. In wheats that are dry the interior farinaceous portion of the corn is easily cut away from the bran; in damp or tough wheats the flour particles adhere more closely to the bran, and appear, instead of being easily cut or scraped off by the rollers, to be smeared into closer attachment with it. Further, such particles of the interior which have not fallen into flour in the original breaking process, when they come to be reduced by

smooth rollers, possess a kind of adherence and plasticity which causes them to be compressed into cakes or flakes instead of cracking freely into flour. These flakes will not pass the meshes of the "dressing" or sifting apparatus, and, instead of being removed from the system at the proper points as flour, pass from machine to machine as flattened particles, and thus, by appearing in unlooked-for quantities in unexpected places, overload the machines and interfere with their correct operation.

Moreover, as the reduction or grinding is gradual, and accomplished by a series of rollers, at each passage through the rollers more pressure than usual is applied in a vain attempt to disintegrate the material. The result of this is greater friction, and consequently a higher temperature both of the rollers and of the stuff passing through them. This higher temperature causes the excessive moisture present in the meal to evaporate, and this moisture is condensed upon coming in contact with the cool framing of the machines and with the surfaces of the conduits, pipes, elevators, and conveyors through which the ground material passes. The condensed moisture combines with the flour-dust, with which all the internal spaces of the machines and conveying apparatus is charged, and together they form an adherent paste. If the hot moist air be not drawn away from the roller-mills and dressing-machines, the gauze with which the latter are covered is liable to be clogged, and the machines become inoperative. The paste which forms on the internal surfaces either ferments and becomes putrid and stinking, or falls off and gathers into balls or lumps, which stop up passages, and thus by closing an outlet, it may be, from a machine or conveyor, cause a "choke-up," one of the terrors of the miller, and possibly a break-down and stoppage of the whole mill. Again, it is easy to conceive that a material that is merely flattened and will not break up into flour and pass the meshes of the sifting apparatus, must be carried onward through the system until eventually it finds its way to the offals, and thus the yield of flour from such wheat is *pro tanto* reduced.

These are but instances out of the many troubles which the use of damp soft wheats occasion in roller-milling. And it is because of these troubles that owners of mills on a large scale will not employ native wheats in damp seasons. No concession in price is sufficient inducement to them to risk the disorganisation of the mill, and probable loss of reputation, by turning out inferior or irregular flour, and neither good quality nor regularity can be attained if it be attempted to use damp wheats in roller-milling.

There are, however, two modes in which these wheats may be used. First, by submitting them to an artificial drying process

of some kind; or secondly, by mixing them with some description of very brittle wheat, and allowing the mixture to lie for a considerable time. With regard to the first expedient, few mills are provided with such an apparatus, though formerly in Ireland a kiln was the necessary accompaniment of almost every mill. The objection to the provision of a drying apparatus is that it occupies much space, is required only in some seasons or parts of seasons, and that wheat can seldom (especially if the provision exist) be bought cheaply enough to pay for the loss of weight of the water evaporated and the expenses of the operation. Moreover, unless skilfully performed, there is a danger of damaging the wheat by overdrying or irregularity of drying, and, after all, the dried wheats yield flour of poor quality and flavour. Any neglect in the direction of allowing the moisture which has been evaporated to condense on the surface of the grain, causes a sour or bitter taste. Artificial drying is in no sense a satisfactory substitute for sun-drying, and it is the misfortune of our farmers that our climate is not well adapted for producing dry wheats, whatever its influence may be in producing large yields. As there is now an abundant supply of suitable wheat of foreign growth, millers will not take the trouble of drying home-grown wheat unless they can make money by doing so. The other way of alleviating the evil of dampness is by mixing the damp wheat with some description of very dry foreign wheat. Californian, Indian, and Russian wheats are thus employed. The mixture must lie together for some weeks, and the dry corn, which is selected because it is too brittle to manufacture alone, absorbs some of the moisture of the native wheat, to the mutual advantage of each sort.

In some mills each variety of wheat is treated separately, and the resultant flours are sold either separately or mixed, so as to produce the required standard of quality. Nearly all wheats differ in physical characteristics: some are hard, others soft. There are gradations of difference: some wheats, while tender or mellow, are yet of a firm texture; others are soft, and moist or pasty. Some hard wheats are brittle, others are tough; and experience shows that wheats possessing these different characters require different treatment in the mill. For instance, it is obvious that the farinaceous part of a mellow or tender wheat will fall into flour more readily than that of a hard firm wheat. The latter would demand closer grinding and a more frequent repetition of the process to reduce the interior to flour of the same degree of fineness as would be obtained by less severe and less frequent treatment of soft wheat. Thus the mode of grinding which is well adapted for the one would not be suitable for the other. For this reason the better practice is to grind the

wheats separately. The American or Hungarian millers, whose flour so largely takes the place of that formerly made in the United Kingdom, have no such matters to consider, as they grind only the wheat of their own district from one season to another, and their processes require only such slight regulations as the alterations of weather demand. The English mill has to be designed so that its work may be varied to grind to the best advantage alternatively either hard or soft wheats or any medium variety.

A miller, to carry on his business with financial success, must be independent of any one source of supply, and must be able to make flour of his standard quality from whatever may happen to be the cheapest combination of wheats of the day. Each miller (except those in a few districts) makes his own standard qualities, which are known in the market, and he has to produce these standards of uniform quality all the year round, notwithstanding any difference in the variety of available wheats. Although there is no doubt that better work may be made when wheats are milled separately, yet the difficulty of mixing flours completely after they are made, and the greater ease, convenience, and cheapness of mixing wheats, cause generally a preference to be given to that course; but in all cases there can be no doubt that each sort of wheat, on account of the different matters it may contain, should be cleaned separately, and that the mixture of wheats should be made after the wheats have been cleaned. If this course be followed, the resultant mixture is composed of grains not only of different characteristics, but also of berries of various sizes, comprising for instance the large berries of the native wheats, and the small berries of such as Russian wheats, and the berries of all intermediate sizes.

The first process of the mill proper is, in theory, to split the wheat-corn at and in the direction of the crease so as to divide the two lobes, and thus to liberate any dust that may be deposited in the crease, and at the same time dislodge the germ from its seat. This operation is accomplished with more or less approach (generally less) to the theoretical idea by passing the wheat between fluted rollers or corrugated discs, and it is clear that if the rollers or discs be set at such a distance apart as would correctly split the larger corns, the smaller corns would escape untouched; and, *vice versâ*, if the machines were set to split the smaller corns in the way desired, then the larger corns would be too much broken. Before then the wheat is fed to the first breaking machine, it is "sized" or graded into two, three, or perhaps four sizes, and each size is delivered to a separate breaking machine, which can thus be regulated accurately to crack the corns to the desired degree.

It has already been said that the purpose of the first stage of the system is to break the farinaceous portion of the wheat into small fragments and to avoid making flour. This end is accomplished by a series of "breaks," varying in practice from four to eight, the number most generally used being six. The invention and development of the "roller mill," and especially the adoption of chilled iron as the material for rollers, has incontestably left the field in possession of that machine as the best instrument that has hitherto been employed for the purpose. The rollers employed for the breaks are grooved, generally so as to leave teeth with a sharp edge, the grooves varying in number from eight up to thirty to the inch. The operation of the breaks is thus conducted:—

The wheat is passed through the first machine, and the broken pieces, then called "chop," are carried to a sifting reel covered with coarse wire cloth, which allows all flour and small fragments to pass through. What will not pass through is fed to the second "break," which reduces the material to smaller fragments and opens and spreads out the bran. This "chop" is taken to another reel for the removal of all its finer parts, and what remains goes to the third break, and so on through the series, each succeeding roller-mill having rolls with finer grooves than its predecessor, and the rollers being set so as to leave less and less space between them. From the last roller-mill the bran should emerge freed from all flour-bearing cells. The reels by which the fine stuff is sifted out between each break are termed "scalpers." Recently, horizontal sieves have been introduced to take the place of reels in the scalping operations.

Ideal perfection of the breaking process would leave the bran in large unbroken flakes, freed from all the flour-bearing cells of the interior, and the farinaceous portion of the wheat should be found in small pieces, and no flour should have been made in this stage of the process. But in the practice of the mill the results obtained are very far short of this ideal perfection. In actual practice the products yielded by the breaking process are bran, a considerable percentage of flour when tender wheats are used, a less percentage from hard wheats, and "semolina," "middlings," and very fine middlings called "dunst." These three last are the gritty particles of the interior of the wheat, which, after "purification," under further treatment to reduce them to flour by smooth rollers, yield the finest flours.

The bran and the flour from the breaks are finished commercial commodities. The first operation after the breaks is a sifting process, to separate the gritty products from the flour, by means of appropriate dressing-machines. But, as has been

already explained, these "grits" are mixed with bits of bran of the same sizes, and many of them have bran attached to them. They require to be purified, and the class of machines to which the name "purifier" has been applied is certainly the most important in the history of modern milling.

There are two types of these machines in general use: one is known as the wind machine or gravity purifier, while the other is the sieve purifier. In the former machine the semolina to be purified falls through a succession of graduated and controllable currents of air, by means of which the heavy pure semolinas are freed from all the lighter particles, whether of bran or of branny semolina, and these latter are again divided and subdivided into various qualities. These wind machines can be used only for the larger sizes of semolina. For the smaller sizes and for middlings sieve purifiers must be used. The essential part of these machines common to the very many constructions in existence is a chamber, air-tight on all sides except the bottom, which is formed by a sieve covered with silk cloth and having a rapid reciprocating or joggling motion; the air in the chamber above the sieve is drawn away by an exhaust-fan, so that a current of air is created passing upwards through the meshes of the silk cloth of the sieve. The material to be purified is delivered in an even stream to the head end of the sieve, which is of a long and narrow rectangular shape, and passes along it in a thin layer towards the tail; by the mere shaking of the sieve the middlings arrange themselves in horizontal strata, the lighter and more branny particles rising to the surface, and the heavier and purer next the silk cloth. The slight current of air passing upwards through the sieve assists this operation, and the meshes of the silk cloth being proportioned to the sizes of the middlings, the heavier and pure particles fall through and are collected in a receptacle below the sieve, while the lighter and inferior particles are kept in suspension and pass onwards to and over the tail of the sieve, and any very light particles are lifted up and carried away by the current of air to a dust-room provided to catch them. "Dust-catchers," which are in their various forms air-filters, are here employed to catch all these very light particles. Recently, purifying machines have been constructed containing a filter in themselves, as well as a device by which particles that have been lifted from the mass, but are too heavy to be carried away by the air-current, and would therefore fall back again, are intercepted in their fall and divided from the middlings.

All these processes of purification are very delicate operations, and all the gritty particles require to be accurately "sized," so that each size may be treated by a machine having a current

of air exactly proportioned to the specific gravity of the semolina or middlings to be treated. The separation into sizes is accomplished by sizing reels or sieves. And that there may be no waste, by reason of flour-dust being carried off by the air currents, it is of the greatest moment that all the semolinas and middlings should be perfectly freed from all floury particles before they enter the purifiers.

The importance of the purifying operations in "gradual reduction" cannot be exaggerated. It is the foundation of the success of the whole process. By purification a certain portion of the flour-bearing cells of the wheat-corn can be completely freed from the contamination of bran, and other portions can in various degrees be made more or less free. From these pure middlings the highest quality flours are produced, and the aim and object of the miller is, by skilful manipulation of his machinery, to obtain from wheat the greatest possible percentage of pure flour, to be sold either as fine flour (and called, after an American fashion, "Patent"), or to be mixed with the various lower qualities, which the mill must produce from the less pure middlings and in the breaking process, and form what is called "straight grade" or "straight run." While the "purifier" by enabling the miller to get rid of the admixture of bran specks from the middlings laid the foundation of the process, the use of the smooth roller-mill has been of immense advantage in the same direction by its operation in breaking down or reducing middlings containing bran specks to flour without cutting up the branny particles to the same extent as millstones.

The stage has now been reached in our account of the process when the semolinas and middlings obtained in the "breaks" may be supposed to have been purified and to be ready for reduction to flour. The reduction of these is accomplished in much the same manner as the "breaking" of the wheats. Each size of purified semolina or middlings should be cracked down on separate roller-mills; the flour produced in the passage between the rollers is to be sifted or dressed out. If the particles remaining be still of sufficiently large size, they should be re-purified, and passed on to other rollers, and then the produce of those rollers is re-dressed, flour removed, and the "gradual reduction" is repeated until no flour of value above the worth of offal can be obtained. But throughout this middlings reduction, there is a possibility of separating and removing branny matter at each purifying and at each grinding operation, and the most is made of these opportunities. Each different quality of middlings and each grinding yields a flour of different quality, and these flours can be kept separate for sale, or combined in any proportions that may suit the trade or

demand of the mill. In Hungary as many as ten different qualities of flour are made. It is in this part of the process that there are the greatest differences of system and practice in mills.

It is now necessary to refer more particularly to the "roller-mill" as a machine, and to attempt a general description of the points which are common to the many types of this machine now in use. One function of the roller-mill in the "breaking" process has been described; the other duty of roller-mills is to crush or grind into flour the particles produced by the breaks after they have been "purified." For the first duty the rollers are grooved or fluted; for the second they are smooth. For the "breaks" chilled iron rollers exclusively are used; for the grinding of the particles, chilled iron and porcelain rollers are employed. Cast iron, cast steel, forged steel have been tried, but the hardness of the coats of the wheat, and the various odd articles of metal or stone that in spite of all precautions find their way to the rollers, wear away these materials very rapidly.

Space cannot be given to a description of the vast variety of roller-mills that are in the market, nor to a discussion of the principles of their construction, or of the differences between the many modes of accomplishing the same object. Such investigations are more appropriate to the journals of the milling trade. A general sketch of roller-mills may, however, be attempted. The rollers vary in length from 9 inches up to 40 inches, and the constructions most generally in use adopt diameters of from 8 inches to 12 inches. Some engineers prefer rollers of very much larger diameters. The grooving of a roller when viewed in cross section has a saw-like appearance, varying in fineness from 8 or 10 up to 30 or 35 grooves to the inch. The saw-teeth also vary somewhat in form, and especially in the depth to which the grooves are cut. One maker prefers a tooth rounded instead of sharp at the point, but it is a form not much used in this country. On the contrary, the general view is that it is needful to keep the teeth of the rollers moderately sharp in order that they may cut and not crush the grain, and yet with not too keen an edge or they will cut up the bran. The grooving even of chilled iron wears gradually, and the life of a roller in an efficient condition may be reckoned at about two years. The roller then requires to be regrooved. The grooves preferably are cut in a spiral direction, there being an idea that better work is obtained by the scissors-like action of the teeth; but, however this may be, there is a real advantage in avoiding the danger of the teeth of the two rollers interlocking and destroying each other, as they would do if the grooves on each were parallel with the axis and the peripheries came into contact with each other.

Appliances are fitted to all roller-mills by which an elastic pressure may be applied to the material passing between the rollers. The smooth rollers accomplish their work more by a crushing than a cutting action, and consequently greater pressure is applied through them to the goods than is the case with grooved rollers. And as the pressure is in proportion to the length of the working surfaces, the greater the length the greater is the pressure on the axles, and the greater the difficulty in keeping them cool and the bearings free from wear, so that of necessity smooth rollers are shorter than grooved rollers. The surface of these rollers, though smooth, is not polished; the condition desired is that the surface of the metal should be quite smooth to the touch, while it has a dull appearance which has been likened to finely frosted glass. It is this very slight roughness of surface which gives the rollers a slight bite upon the material that passes between them, and thus, by means of pressure and the difference of speed at which the surfaces of the two rollers are made to travel, enables them to resolve it into flour. It is because porcelain has a very slight granular surface that some prefer to use smooth rollers of this material.

A "roller-mill" consists of an iron frame of very solid construction, containing generally one or two pairs of rollers, and is fitted with all necessary appliances. Roller-mills have been built containing as many as six pairs of rollers, but this construction has been abandoned. In the ordinary type a pair of rollers is placed horizontally in the frame, with their spindles in the same plane; the carriages or bearings of the spindle of one roller are fixed to the frame; the bearings of the second roller are movable and adjustable, so that the second roller can be made to approach or recede from the first roller, but always in perfect parallelism with it. To apply pressure to the material to be reduced by passing between the rollers various devices are adopted, employing either alone or in combination screws, wedges, levers and weights and springs. But while it is important that the pressure should be constant in amount, it is also necessary that it should not be rigid, in order that provision may be made for the recession of the movable roller if a piece of metal or other ungrindable object should pass between the rollers. There must be power to exercise the most delicate adjustment from time to time to suit the work, and the pressure must be constant and alike at each end of the rollers, and there must be an arrangement for throwing the rollers instantly apart in case of need, and of bringing them to the original relative situation without entailing the trouble of readjustment.

Placed above the rollers is a hopper, containing the material

to be ground, and fitted with a roller or other feeding device by which the material is to be delivered to the meeting point of the rollers in a thin, regular, continuous stream, quite equal in volume at all points of the length of the rollers. The feed must also be capable of adjustment to the greatest nicety, and is to be arranged so that the stoppage of the rollers or their being thrown apart instantly stops the delivery of the feed. There are devices innumerable for these and other subsidiary points about the roller-mill. To the lower side of the rollers are applied scrapers, for the purpose of removing any of the ground material which may stick to the rollers. Very frequently two pairs of rollers are arranged in one frame, all the rollers being parallel and in the same plane. A duplication of all the arrangements is then necessary. The material which has passed between the rollers is collected in a hopper below them, connected with a pipe which directs the stuff to any desired point. There is a very common arrangement by which three rollers are made to do duty as two pairs, the rollers standing one above the other, the middle roller being common to each pair. All roller-mills are cased in so as to prevent the escape of dust, and, as the rollers become warm by friction in working, it is usual to draw away the warm air from the case by the application of an exhaust-fan.

The motion is always conveyed to roller-mills by belts; sometimes each roller is driven by a separate belt; in other examples each one of a pair is so driven, the other roller being driven off the spindle of the first by cog-wheels. But either in one way or the other each roller is separately driven. And it is necessary to do so, because there is always a difference in the speed of the two rollers of a pair, the difference being varied. The proportions of the speed are some such as 4 to 5, or 3 to 4, or 2 to 3, or 2, 3, 4, or 5 to 1. The mode of action is in fact that the goods are held and passed on by the slow roller, while the swifter movement of the fast roller in the case of the grooved rollers cuts the stuff up, and in the case of smooth rollers drags apart and disintegrates the particles to be reduced by a tearing action proportionate in violence to the difference of the speed of the rollers and the amount of pressure applied. If a pair of smooth rollers be run at equal speeds, their action is simply to squeeze the particles that pass between them and flatten them so that they emerge in the form of small cakes or flakes, while those which are reduced by rollers driven at a differential speed come from them in a powdery condition fit for sifting.

The adoption of the roller-mill has also demanded a modification of the dressing-machine or silk reel. For, especially with soft wheats, there was discovered a tendency in the particles of

the meal to appear in a "flakey" condition rather than in the round and detached condition in which the millstone delivers it. If it were attempted to dress out the flour from this flakey meal by means of the ordinary reel, some of the "flakes" would pass out at the tail of the reel, although only a very slight friction was required to make them fall into flour. The invention of the "centrifugal" flour-dressing machine overcame the difficulty. It consists of either a cylinder or hexagon, of from two to four feet diameter, covered with silk cloth, revolving at a moderate speed, and having a central shaft furnished with arms to which blades or beaters are attached set within a short distance of the interior of the silk surface. These beaters revolve somewhat rapidly, and throw the meal to be dressed or sifted against the silk. The flour passes through the meshes, and the residue goes on to the tail of the cylinder and so out of the machine. The slight friction is sufficient to disintegrate the little flakes. As these cylinders are very much shorter than the old reels, much space is saved in the mill by their employment.

An important point remaining to be noticed is the question as to the comparative amount of flour which can be extracted from a given quantity of wheat by one process or the other. Under the millstone system it may be said that about 75 per cent. of the original cleaned wheat was an average yield; under the roller system practice varies very much; in the best mills and from the dryest and best wheats 75 per cent. is to be obtained, but it may be said that from 68 to 72 per cent. has been the more general result. It must, however, be remembered that the 75 per cent. of millstone flour contained a proportion of what is now ranked as offal, and that the smaller percentage of roller-made flour is of much better quality than the millstone flour.

Under the low-grinding millstone process, nearly the whole of the flour yielded by the wheat ground was of one quality, alterations of quality of flour being attained by varying the sorts of wheat employed. Under the gradual-reduction process very many qualities of flour are obtained from the same wheat. The best flours made from wheat even of cheap and inferior quality may be better than millstone flour made from the most expensive and finest wheats; while from appropriate wheats a large percentage of fine flour selling at a high comparative price may be extracted, leaving the remainder equal in quality to the whole quantity of flour produced by the millstones. It is the better quality and higher value of the flour made by the gradual reduction process that has induced mill-owners to expend in building and refitting mills sums that have been estimated at several millions sterling. The earlier adventurers, even with the draw-

backs arising from the defects of an undeveloped system, did well, and their more hesitating neighbours have been compelled to follow the example of the leaders. In fact, the standard qualities of flour have been very much raised of late years, and millstone flour is now no longer saleable in competition with roller-made flour from the same wheats.

In this sketch of modern milling in this country no more has been attempted than to show the general effect of the revolution that has taken place in machinery and in practice, and the difficulties that now present themselves in the way of adapting the new system to the reduction of our comparatively soft native wheats. Until some fresh development takes place, the demand from millers will be for dry firm wheat with a clear sharp fracture, and damp soft wheats will be a drug in the markets. It is, however, certain that finality in the art or practice of milling has not yet been attained, and that mechanical science will sooner or later provide a simplification of the somewhat complicated processes now in use, as well as means whereby wheats in the condition of average English crops may be reduced to flour without the drawbacks that now stand in their way and reduce their prices as compared with their foreign competitors.

V.—*The Practical Value of Dung as Compared with Artificial Manures.* By R. Vallentine, Burcott, Leighton Buzzard.

The chief object of this paper is to show by a variety of evidence, in short compass, what is the *practical* value and cost of manure obtained by the consumption of some well-known kinds of cattle-food. In order to obtain some standard—some starting-point—to elucidate the subject, I have calculated the rate of increase of carcase weight of nearly all the classes of cattle exhibited at the Islington Shows for three years past. For the purpose of giving as clear a statement as possible, the average age in weeks is given, and the rate of increase of carcase or butcher meat is ascertained, by a rule applied to the known living weights. The actual carcase weight of several of the prize beasts has been obtained from the butchers who killed them, not only for the cattle at one Show, but at several.

The dead weight in proportion to the living for fat beasts runs from 62 to 72 per cent. The best animal at the Show of 1885 had a proportion of 70 per cent. of carcase weight. Some others had only 62 and 65 per cent. It is a general rule, however, in all the classes to allow $66\frac{2}{3}$ per cent. for the dead

INCREASES IN WEIGHT OF CATTLE AT THE SMITHFIELD CLUB SHOW FOR THE THREE YEARS 1885–87.

BREED	1885				1886				1887			
	No. in class	Average age in weeks	Increase per week in lbs.	Total in 8 lb. stones	No. in class	Average age in weeks	Increase per week in lbs.	Total in 8 lb. stones	No. in class	Average age in weeks	Increase per week in lbs.	Total in 8 lb. stones
Cattle under 2 years of age												
Devon	7	90	$8\frac{1}{2}$	96	8	94	$8\frac{1}{4}$	97	5	98	$8\frac{2}{5}$	103
Hereford	5	86	$10\frac{1}{14}$	$108\frac{1}{4}$	11	89	$9\frac{1}{2}$	$105\frac{3}{4}$	10	$91\frac{1}{2}$	$10\frac{1}{8}$	116
Shorthorn	8	96	$10\frac{8}{9}$	129	6	94	10	$117\frac{1}{2}$	7	97	$9\frac{4}{7}$	116
Sussex	8	98	10	$122\frac{1}{2}$	8	88	$9\frac{3}{4}$	$107\frac{1}{4}$	7	$94\frac{1}{2}$	$10\frac{1}{5}$	120
Polled Angus	7	88	$10\frac{3}{4}$	$117\frac{1}{2}$	5	97	10	$121\frac{1}{4}$	8	96	$10\frac{1}{5}$	122
Cross-Breed	11	92	$10\frac{1}{15}$	$115\frac{3}{4}$	4	93	$10\frac{1}{4}$	119	11	$89\frac{1}{2}$	$10\frac{1}{5}$	114
General averages	—	$91\frac{2}{3}$	$10\frac{1}{6}$	115	—	$92\frac{1}{2}$	$9\frac{2}{3}$	111	—	$94\frac{1}{5}$	$9\frac{2}{3}$	$115\frac{1}{6}$
Cattle under 3 years of age												
Devon	13	149	$6\frac{7}{8}$	$125\frac{1}{2}$	7	145	$7\frac{1}{7}$	129	10	144	$6\frac{9}{10}$	124
Hereford	6	$140\frac{1}{2}$	$8\frac{1}{5}$	144	3	131	9	147	15	135	$8\frac{3}{5}$	145
Shorthorns	12	$145\frac{1}{2}$	$8\frac{6}{7}$	$162\frac{1}{8}$	10	150	$8\frac{9}{10}$	167	16	$142\frac{1}{2}$	$8\frac{5}{7}$	155
Sussex	6	$148\frac{1}{2}$	$8\frac{5}{7}$	161	5	140	$8\frac{4}{5}$	154	6	139	9	156
Polled Angus	7	141	$8\frac{5}{8}$	154	4	138	9	155	7	142	$8\frac{5}{6}$	157
Cross-Breed	20	143	$8\frac{2}{3}$	154	2	142	10	177	11	141	$8\frac{1}{2}$	149
Welsh	—	—	—	—	—	—	—	—	—	—	—	—
Red-Polled	—	—	—	—	—	—	—	—	5	147	$7\frac{1}{2}$	138
General averages	—	$144\frac{1}{2}$	$8\frac{1}{3}$	150	—	141	$8\frac{5}{6}$	155	—	$141\frac{1}{3}$	$8\frac{2}{7}$	$146\frac{1}{3}$
Cattle under 4 years of age												
Devon	4	194	$6\frac{1}{2}$	$157\frac{1}{2}$	8	181	$5\frac{7}{8}$	133	10	190	$6\frac{1}{5}$	147
Hereford	4	187	$7\frac{3}{7}$	$173\frac{5}{8}$	4	184	8	184	9	189	$7\frac{1}{5}$	170
Shorthorns	9	188	8	186	3	190	8	190	9	191	$7\frac{1}{3}$	177
Sussex	3	175	$7\frac{3}{4}$	$168\frac{3}{8}$	4	185	$7\frac{3}{4}$	179	6	$194\frac{1}{2}$	$7\frac{1}{2}$	182
Polled Angus	2	198	7	$172\frac{5}{8}$	2	197	7	172	2	$189\frac{1}{2}$	$7\frac{2}{3}$	181
Cross-Breed	6	192	$7\frac{5}{8}$	$182\frac{5}{8}$	8	188	$7\frac{1}{2}$	176	8	191	$7\frac{1}{2}$	179
Welsh	—	—	—	—	—	—	—	—	11	185	$7\frac{2}{3}$	177
Red-Polled	—	—	—	—	—	—	—	—	4	177	$6\frac{7}{11}$	147
General averages	—	189	$7\frac{2}{3}$	173	—	189	$7\frac{1}{3}$	$172\frac{1}{3}$	—	$188\frac{1}{8}$	$7\frac{1}{8}$	170
Welsh	3	196	$7\frac{2}{3}$	187	3	179	$7\frac{2}{3}$	172	—	—	—	—
Red-Polled	6	138	$7\frac{3}{7}$	128	3	146	8	146	—	—	—	—
Red-Polled	—	—	—	—	3	187	$6\frac{1}{3}$	148	—	—	—	—
General average increase of all the classes per week, save Highlanders	—	—	$8\frac{1}{3}$	—	—	—	$8\frac{1}{5}$	—	—	—	$8\frac{1}{3}$	—

weight—viz. to take off one third of the living weight. The greatest amount of increase of any animal in the 1885 Show was No. 80, which made a return of about 13 lbs. per week, according to the rule of calculation. The smallest rate of increase is only 5 lbs. per week—a wide difference. The relative cost of feeding must, however, in all cases decide where the greatest profit or smallest loss may be.

In the tabular statement on page 109 it will be observed as a coincidence that the average weights over three years are so much alike.

Most cattle-feeders know that early maturity should be aimed at, with a view to profit. These tables show most distinctly how much greater the increase is per week under two years than at any greater age.

						lbs.
The different classes	under	two	years showed in 1885	an average	gain of	$10\frac{1}{6}$
"	"	three	"	"	"	$8\frac{1}{3}$
"	"	four	"	"	"	$7\frac{2}{3}$

Year after year the result is pretty much the same. If there are any doubts whether fattening cattle on dear food is a paying concern at any age, there need be no doubt whatever that it is a costly piece of business to keep a beast of only 100 stones for two years afterwards. Not only does the animal make less return per week, but even consumes more food.

Some years ago Sir J. B. Lawes carried out an experiment at Woburn Park Farm on fattening oxen. The number under trial was 44, and the experiment was continued for 53 days. Everything connected with it was carried out with the greatest care and skill. Detailed accounts are given, with very minute particulars. All I now aim at is to give an abstract of the kind and quantities of food consumed, litter used, &c., and then work out the cost according to my own plan. Sir John Lawes says nothing whatever about the profit or loss. To get at anything like a standard for cost, the market prices of everything in connection with the experiment must be given, besides a charge made for attendance and interest on capital invested.

FOOD, &c., USED IN THE EXPERIMENT.

lbs.		£	s.	d.
14,804	linseed-cake, and linseed-meal compound, at 1*d*. per lb.	61	13	8
36,097	clover cut into chaff, at 4*s*. per cwt.	64	8	0
124,115	swedish turnips, at 6*d*. per cwt.	27	14	0
44,566	litter, at 2*s*. per cwt.	39	16	0
190,853	dung—44 oxen = 333 weeks of 1 beast, attendance, interest, &c., at 1*s*.	16	13	0
	Total Cost	210	4	8

		£	s.	d.
The increase of live weight 4,558 lbs. = 2,734 lbs. meat at 8*d.* per lb. =		91	9	4
There were 85⅓ tons dung, which costs nearly 28*s.* per ton =		118	15	4
		210	4	8

Carcase increase per week, 8 lbs. at 8*d.* = 5*s.* 4*d.*—Total cost per week 12*s.* 7½*d.*

The following figures are taken from the reports of Dr. Voelcker's Woburn experiments for the Royal Agricultural Society of England:—

Bullocks making Manure for Permanent Wheat Experiments.
['Journal' for 1880, Part I., page 131.]

	cwts.	qrs.	lbs.	
No. 1 . .	9	1	3	Total weight of four bullocks on October 3, 1878: 1 ton 18 cwts. 15 lbs.
„ 2 . .	9	1	24	
„ 3 . .	10	0	8	
„ 4 . .	9	1	8	

Each bullock received daily as food: 4 lbs. decorticated cotton-cake, about 6½ lbs. Indian corn-meal, 48 lbs. of white turnips, and 8 lbs. of wheat-straw chaff; and by November 5, that is in 5 weeks, they had consumed:—

		£	s.	d.
Decorticated cotton-cake .	5 cwts. at 8*s.* per cwt.	2	0	0
Indian corn-meal . . .	8 cwts. at 7*s.* „	2	16	0
White turnips . . .	3 tons, at 10*s.* per ton	1	10	0
Wheat-straw chaff. . .	10 cwts. at 2*s.* per cwt.	2	3	0
		8	9	0

and trodden into dung 11½ cwts. of wheat-straw cut into chaff of about 2 inches in length. The dung made 2¼ tons, when rotten.

On November 5, the bullocks weighed as follows:—

	cwts.	qrs.	lbs.	Gain from October 3 to November 5 = 5 weeks. qrs.	lbs	
No. 1 . .	9	2	5	1	2	Total gain in 5 weeks: 1 cwt. 1 qr. 4 lbs.
„ 2 . .	9	2	17	0	21	
„ 3 . .	10	1	27	1	19	
„ 4 . .	9	2	26	1	22	

This is equal to 1 bullock for 20 weeks. Calculating that the carcase weight would be equal to $\frac{6}{10}$ of the live weight, the total carcase increased weight would be 86 lbs., or about 4⅓ lbs. per week per bullock.

	£	s.	d.
The cost of food and litter brought down . .	8	9	0
Attendance, interest, &c., at 1*s.* per week . .	1	0	0
	9	9	0
Cr. 86 lbs. meat, at 9*d.* =	3	4	6
45 cwt. of dung produced, cost 2*l.* 15*s.* per ton =	6	4	6

The cost of the food and litter are put at market prices, including rail and road carriage. Roots at 10*s.* per ton under market prices. Cotton-cake and maize-meal have been dearer than charged above, though cheaper now. On the other hand, the return for meat at 9*d.* per lb. is more than the value at present. Food, meat, &c., fluctuate so frequently in value and cost that no exact prices can be fixed upon; the object is to get as near an

approximation as possible without running into fractions. In the Woburn experiments the prices of oil- and cotton-cakes and maize are sometimes given, but for the clear understanding of the object of this paper uniform prices will be used as standards.

Bullocks making Manure for Barley.

['Journal' for 1880, Part I., page 137.]

Four bullocks for 5 weeks each, equal to 20 weeks of 1 beast. Total increase 2 cwts. 2 qrs. 3 lbs. live weight = 169 lbs. carcase at 9*d.* per lb. = 6*l.* 6*s.* 9*d.* Meat $8\frac{1}{2}$ lbs. nearly per week per bullock.

Cost of food, litter, attendance, &c., as for wheat manure :—

£	s.	d.	
9	9	0	
6	6	9	Credit meat
3	2	3	Cost of dung

45 cwt. dung, at 27*s.* 6*d.* per ton = 3*l.* 2*s.* 3*d.*

['Journal,' 1881, Part I., page 113.]

Four bullocks for 5 weeks each, equal to 20 weeks of 1 bullock.
Total live weight increase 1 cwt. 3 qrs. 1 lb., equal to 118 lbs. carcase—

	£	s.	d.	
at 9*d.* per lb. =	4	8	6	Meat, 6 lbs. nearly per week per beast.
45 cwt. dung =	5	0	6	Dung cost at 45*s.* per ton.
	9	9	0	

Altogether twenty-four experiments have been calculated in the same manner as the examples given. The food, litter, and attendance go to the debit of the beasts, the meat and manure to their credit. A summary of the whole is given on the opposite page.

I have now, I think, adduced sufficient evidence to show that, whatever kind of food cattle may be fed upon, the average rate of increase in carcase weight per week amounts to only about 8 lbs. The pick of beasts at the leading shows; the feeding experiments carried out with forty-four head at Woburn Park Farm some time ago by Sir John Lawes; and the experiments lately going on, and being continued at Woburn under the accomplished management of Dr. Voelcker for the Royal Agricultural Society of England—all agree at least in one point, that only about 8 lbs. of meat per week can be calculated upon from animals of ordinary age. The best boxes, the best attention, the best, dearest, and most palatable food, in any quantity, has only hitherto produced about 8 lbs. of increase per week—on an average of all the best fed cattle in England.

Dung is merely what is added to the straw. If one waters one ton of straw and does nothing else but let it lie about for a time, something like four tons of mere wet straw-dung may be obtained. The manurial value of a ton of straw is estimated at

Summary of the Cattle-feeding Experiments.

Kind of food	Weeks=to 1 beast	Gain per week in lbs. carcase	Total cost			Cost per week			Cost of dung per ton		
	weeks	lbs.	£	s.	d.	£	s.	d.	£	s.	d.
Cotton-cake and maize .	20	$4\frac{1}{3}$	9	9	0	0	9	5	2	15	0
Ditto	20	$8\frac{1}{2}$	9	9	0	0	9	5	1	7	6
Ditto	20	6	9	9	0	0	9	5	2	5	0
Ditto	20	$4\frac{1}{3}$	9	9	0	0	9	5	2	15	0
Ditto	15	$10\frac{2}{3}$	9	7	0	0	12	$5\frac{1}{2}$	1	6	8
Ditto	15	$8\frac{2}{3}$	9	7	0	0	12	$5\frac{1}{2}$	1	15	0
Ditto	12	$11\frac{1}{6}$	4	18	0	0	8	2		—	
Ditto	12	$14\frac{1}{4}$	4	18	0	0	8	2		—	
Cotton-cake	13	5	6	17	6	0	10	7	1	6	8
Maize-meal, &c.	13	$6\frac{1}{3}$	6	8	6	0	9	$10\frac{1}{2}$	1	2	1
Cotton-cake and maize-meal	14	$6\frac{1}{7}$	5	10	0	0	7	10	1	7	6
Ditto	14	8	5	10	0	0	7	10	0	18	0
Ditto	14	12	5	10	0	0	7	10		—	
Ditto	14	$7\frac{1}{5}$	5	10	0	0	7	10	1	6	6
Cotton-cake, maize . . .	40	$9\frac{1}{5}$	25	10	0	0	12	6	1	10	0
Linseed, &c.	40	$9\frac{3}{5}$	28	0	0	0	13	9	1	18	0
Cotton-cake, maize . . .	27	$10\frac{6}{7}$	14	19	0	0	11	1	1	0	0
Linseed	27	9	18	9	0	0	14	0	2	5	0
Cotton-cake and maize .	27	11	20	13	7	0	15	3	1	18	0
Linseed-cake	27	7	23	2	7	0	17	0	3	3	9
Cotton-cake	17	3	8	1	6	0	9	5	1	17	6
Maize-meal	17	6	7	10	9	0	8	10	1	5	9
Cotton-cake	18	7	8	2	6	0	9	0	1	3	2
Maize-meal	18	$7\frac{2}{3}$	7	11	9	0	8	4	0	16	7
Average		8				0	10	5	1	9	8

about ten shillings, therefore four tons of merely wetted straw is only worth half-a-crown a ton as dung. On the other hand, if a ton of straw be used as litter for twenty weeks for a fattening bullock, receiving about 17 lbs. per day of cake—say of cotton and linseed cake—besides clover, hay, and roots, the original ton of straw has most costly additions made to it. Is the manure worth the extra cost and additions? Most people would answer no. As few farmers have either boxes or covered yards to preserve any kind of manure, what part of the original value of the manure in the food would remain after repeated washings? Just in proportion to the number and thoroughness of the washings, we may suppose; and these are frequent enough in all ordinary seasons. Again, when dung does contain a good percentage of nitrogen, it seldom shows such favourable results in the crops as artificial manures, containing much less in quantity, but in a more readily available form.

The cost of oil-cake dung is apparently very great. The notion that the land will get richer is true; but will the ordinary farmer who makes it get richer or poorer? Artificial manures

have hitherto produced crops of both corn and roots fully better than dung. If dunging is partially or wholly left off, the crops fall off. Then where is the permanency of dung? If artificial manures containing both phosphates and nitrogen are used, it is known on the best possible authority—that of Sir John Lawes—that after more than forty years' trial, neither does the soil get poorer nor the crops get worse. Further, dung may be applied in very large quantities to all kinds of crops, and although the soil becomes richer and richer, the crops never increase in proportion, nor yet at all in fact: as the yield of corn on dunged land—dunged heavily for forty years—does not increase.

People who know least about artificial manures condemn them. Many say nitrate of soda is the great criminal charged with scourging, wearing out the land, and doing all the evil possible in every respect to the land. Can an authentic account be really obtained of any farm that has been really injured by the judicious use of artificials? If land becomes poor and full of couch, and is dressed with nitrate of soda or such like to make a struggling corn-crop grow, what then if the couch grows faster than the corn, and such a system is continued? Is the manure to be blamed for making the pest grow? If the farmer fails because the couch succeeds too freely, is it right that the manure should have all the blame? What farmer who knows anything much about artificials would use nitrate of soda, or ammonia salts, year after year, alone, without phosphates? No one could continue to do so without loss. This ought to be the greatest reason for having little fear of the land, as by an exhausting process the farmer would injure himself. Neither could any one, if he wished to take a farm for a short period to exhaust it of latent condition, be able to do so, without loss, through moving stock, implements, and all his belongings to a new farm, and from it again in two or three years; therefore, if the right system of manuring were not carried out, the crops would fall off, so that it really would not pay any man to try to continue to wear out the land. Experiments merely continued year after year to determine certain points are only guides to establish principles, but are not, of course, intended for general practice.

On the opposite page is a summary of the experiments carried on at Woburn for ten years, from 1877 to 1886, on the continuous growth of wheat by artificials and by dung.

These estimates are, of course, only approximations, but are as nearly right as they could be at the time they were made; the same principle, however, of calculation applies to all. It is very evident that there is much less loss in growing wheat without

Average Yield of Wheat for Ten Years at Woburn, with the Approximate Cost of Manures, Seed, Rent, Cultivation, and Harvesting; also the Value of the Crops.

No. of Plots	Manures per acre	Bushels per acre, at 4s.	Straw, cwts, at 2s.	Value of the straw	Value of corn and straw	Cost of manure	Rent, cultivation, seed, &c.	Gain per acre	Loss
				£ s. d.	£ s. d.	£ s. d.	£	£ s. d.	£ s. d.
1 & 7	No manure . . .	17	17⅓	1 14 8	5 2 8	—	4	1 2 8	—
2	200 lbs. ammonia salts	25	24½	2 9 0	7 10 0	1 10 0	4	2 0 0	—
3	275 lbs. nitrate of soda	24	25½	2 11 0	7 7 0	1 10 0	4	1 17 0	—
4	Minerals only . .	17½	17⅓	1 14 8	5 4 6	2 10 0	4	—	1 5 6
5	Minerals & 400 lbs. ammonia salts .	38	41½	4 3 0	11 15 0	5 0 0	4	2 15 0	—
6	Minerals & 550 lbs. nitrate of soda .	36⅔	44	4 8 0	11 14 8	5 0 0	4	2 14 8	—
11 B	About 8 tons dung. Cost, as per table, 29*s.* 8*d.* per ton. Money value of food = 21*s.* 3*d.* per ton	27	27	2 14 0	8 2 0	11 17 4	4	—	7 15 4

any manure, than with too costly dung. Thirty-eight bushels of wheat for ten years by artificials, many of the seasons being bad yielding, is at least ten to twelve bushels per acre above the average of the country farmed in the usual way. On the dunged plot there is a loss of 7*l.* 15*s.* 4*d.* per acre annually: so that in ten years there is a total loss of 77*l.* 13*s.* 4*d.*, which is more than the value of farming land. The money value of the food consumed would be 8*l.* 5*s.* 1*d.*, so that whatever way the subject is treated, the result is unsatisfactory. The land has become debtor to a very large amount for a supposed latent improvement.

Cattle-foods of various kinds no doubt contain the amounts of manurial ingredients which chemists assign to them, and the loss by consumption may also be fairly enough estimated. For all this, in real practice, by making dung from dear food and applying it to the land, there is usually a considerable loss when the crops are produced. Dung does not act so quickly as artificials, a small percentage only coming into immediate use. The residue of the dung left after assisting one crop is subjected to continual loss by the usual rainfall in winter, and this for the four or five years that elapse before dung is again applied.

In very wet seasons even dung produces no very visible effect on crops. The soluble ingredients of value may be washed away as soon as produced. Whatever theory there may be on the matter

of loss, almost every farmer found that in the unusually wet season of 1879 the dunged crops appeared to suffer as much as where artificials were used. Nor were the crops much better after any kind of manuring than where nothing was applied. Practically, however, there is an enormous loss of manurial matter from dung before it reaches the field. There is not one farm out of fifty provided with boxes or covered yards to protect the dung from being wasted by washing. In too many instances I have not the slightest doubt that much more than half of the most valuable ingredients of the dung are washed away and utterly lost, so far at least as the producer is concerned.

Compensation clauses for estimating the unexhausted value of cattle-food in manure must be liable to many considerations before any proper estimate could be made of what might be supposed to be left in the land years after the supposed rich dung was applied. It might be possible enough for 20 tons of oil-cake to be consumed annually on a farm, by dairy, young stock, or even fattening cattle, and that, by the manner of wasting the manure in open yards, not 10*l*. worth of the original manurial constituents of 20 tons of cake might be left for the field. In a general way, with large open yards, it is a mere waste of money to purchase dear food with the double object of producing meat and rich dung at the same time. As a rule, therefore, the ordinary farmer looks mainly to the cost of producing meat at the smallest cost for purchased food, without any particular calculation about the maybe hidden value of the dung. Although rather poor, clean land is much to be preferred for entering upon than very foul land which has a charge against it for unexhausted manures. The unexhausted value of manures is altogether a most intricate subject.

The field at Woburn where the experiments have been carried out had no doubt a good deal of unexhausted manurial matter left in it when the experiments commenced. I remember nearly fifty years ago that the land was heavily dunged with rich fattening cattle manure for swedes and mangolds. The crops were heavier about that time than they have been of late. It was the system then to consume one half the root-crop on the land by sheep. The sheep were liberally fed with oil-cake, corn, and hay or clover chaff. The first crop of the course had a heavy dunging. The second crop, barley, was too rank, and fell down long before harvest. To consume a quantity of the produce on the land, and to supplement this by cake, corn, &c., tended, as a matter of course, to produce heavy crops. This was the system pursued for a long time on the Woburn Park Farm. There need scarcely be any doubt that the dung produced by fattening cattle at Woburn fifty years ago cost about

as much per ton as now. I remember the heavy crops of barley perfectly well, as I was a working pupil at the time, and the laid twisted corn was a difficult task for me to cut with the point of the scythe.

Very high farming was carried on at Woburn during a long course of years, and no doubt there still remains some of the unexhausted value of the manures in the land. Whether any one can ever recover and make a profit of the residue remains an open question. The Ducal family at Woburn have, for a century at least, at all times shown a great interest and taken a distinguished lead in agricultural affairs, and the experiments now being carried on at Woburn will annually become more and more valuable as guides to both landlords and tenants.

It is well known that a very great prejudice long existed with many owners, and also occupiers of land, against artificial manures. At present opinions are on the whole very much changing. At one time a farmer was supposed to take—should take—at least as much weight of dung into the field as he expected to take tons of roots out; and nothing could ever be expected to make anything grow so well as dung. At present one ton of artificial manure of the best kind may, with a favourable season, produce 100 tons of roots.

There are many points to be considered regarding the enrichment of the land with dung, &c., as a supposed permanent improvement. Land can, it is well known, be much enriched by large and repeated doses of good dung. All agree in this. Where people disagree is whether the improver of the land is able to improve himself—able to make the dunging pay?

Some of the Woburn experiments tend to show that the soil must have retained some proportion of the unexhausted manures previously applied. In the rotation experiments it is obvious that the land must have been in more than average condition when it produced 19 tons per acre of roots without any additional manure. Phosphoric acid is chemically proved to be retained by almost all kinds of soil for very long after dung or superphosphates have been applied. Bone-dust was used as a manure at Woburn before the discovery of dissolving bones by acid was made known to the world. The largest fragments of the bone-dust applied long ago may still have some influence over the crops.

Sir John Bennet Lawes has shown that even superphosphates, more than thirty years after their application, have had a decided effect upon the increase of the crops where nitrogenous manures were applied on the mineral manured part; and on other parts where no minerals had been previously applied, the crop was inferior. Mineral manures for corn-crops

—minerals alone—are, however, of scarcely any use. This has been thoroughly well proved by such a number of diversified experiments that it appears scarcely worth while to try to prove over and over again what has been already set at rest.

Sir John Lawes' experiments, carried on for such a long period, show that minerals alone for the first sixteen years produced $17\frac{1}{2}$ bushels of wheat per acre. The Woburn experiments for ten years also produced $17\frac{1}{2}$ bushels of wheat per acre. Many other experiments have been recorded of trials with mineral manures for corn. They have all, as a rule, had the same unpaying result.

	Average number of bushels per acre.
The Woburn experiments with mixed minerals and ammonia salts	38
The Rothamsted experiments, 32 years, with mixed minerals and ammonia salts	36
The Rothamsted experiments, 16 years, with minerals and nitrate of soda	$35\frac{1}{3}$
The second period of 16 years the nitrate of soda increased yield to	$36\frac{1}{2}$
The Rothamsted plot, 32 years, with 14 tons of dung annually	$33\frac{1}{2}$

Practically, ammonia salts with minerals produced the same results as nitrate of soda with minerals. The crops with nitrate increased, however, rather than diminished during the last period of sixteen years. Here, then, is the best evidence that no danger to the land need be feared from the proper application of artificial manures. Sir John Lawes' own words are: "When large crops of wheat have been grown by the application of nitrates, or salts of ammonia, with mineral manures, the soil does not appear to have gained or lost fertility."

The working out of the various feeding trials at Woburn which I have given might of course be treated in a very different manner. What is called the spending value of roots, hay, straw, &c., might be charged at any low price, if it were the object to make it appear that the fattening of cattle was a fairly paying business. It must, on the other hand, be obvious that if swedes were charged 5*s.* per ton, hay or clover 2*l.* per ton, and straw and labour allowed for nothing, much of the farm produce would return a very small amount of money.

All calculations connected with the fattening of stock on purchased and valuable home-grown produce should take every local and accidental circumstance into account. For instance, the straw at Woburn is charged at the market value of 2*l.* per ton. In my own village, only ten miles off, straw has, for ten years past, averaged nearly 3*l.* per ton. In some other districts, straw has made at times 5*l.* per ton and hay 7*l.*, whilst roots have fetched from 12*s.* to 20*s.* per ton. It is therefore quite clear that, if the calculations which I have given have

any truth at all in them, a great loss must be sustained by an unvarying system of turning all kinds of produce into meat, and fondly nursing the idea that if the value is not returned by the meat produced, the dung produced will make up all losses in the long run. Of course, meat might get very dear, and farm produce of so little value to sell, that it might be turned into meat. Artificial manures might also become dearer. In fact, the price of almost everything varies from time to time, so that no rigid system can be always right, unless it is to buy in the cheapest and sell in the dearest market, whenever it is at all possible to do so.

I shall now give a short account of my own personal experience in fattening cattle, and also on the use of artificial manures. For a good many years I managed farms for gentlemen in various districts. On every farm a good many cattle were fattened, chiefly with the object of making manure. In some cases cattle were house-fed throughout the whole year, summer as well as winter. The land was on the whole fairly good, and the crops produced were generally good also. The results, however, of the whole system of farming were that very small profits were made. The capital employed was large, the percentage obtained for it on the average was very small. In a few cases of weighing the cattle alive and proving the rate of increase by the carcase weights, rather under 8 lbs. of carcase weight per week was obtained. My experience therefore, as far as it went, showed that an increase of about 8 lbs. per week, as stated in the Woburn experiments, was a fair average increase.

Since I commenced farming, thirty-three years ago, on my own account, a different system has been followed from that which gentlemen of large means thought proper to adopt. My farm of 300 acres contains about 240 acres of arable land. For a time one fourth of the arable, 60 acres, was devoted to growing swedes and mangolds. The average crops have not exceeded 10 tons per acre: sometimes 20 to 30 tons, another time 10 tons, down to nothing with swedes, and in wet seasons only a few tons of mangolds per acre.

For several winters about 60 head of cattle were fed in open yards, and consumed about 1½ cwt. of roots each per day. The whole of the straw was consumed as food and litter. The rate of increase of meat, carcase weight, was only about 6 lbs. per week. During 20 weeks' feeding, the money return per week ranged from 4*s.* to 6*s.*, according to the progress of the beasts and the price of meat. In open yards the cattle made about half a ton of dung each per week. In a tabular form it may be observed that by charging a low value for the swedes and

fodder consumed, the dung, such as it was, was also obtained at a low price.

CATTLE-FEEDING ON ROOTS AND STRAW: COST PER WEEK.

Dr.	£	s.	d.	*Cr.*	£	s.	d.
10½ cwt. roots per week, at 8*s.* 4*d.* per ton . .	0	4	4½	6 lbs. meat at 8*d.*	0	4	0
3 cwt. fodder and litter, at 6*d.*	0	1	6	10 cwt. of dung, cost .	0	2	10½
Interest, attendance, &c.	0	1	0				
	£0	6	10½		£0	6	10½

The dung at this rate would cost 5*s.* 9*d.* per ton.

Cattle-feeding on purchased food and home produce of hay, clover, and roots, based upon previous calculations, shows such results as might be expected now. When the allowance of roots is confined to ½ cwt. a day instead of 1½ cwt., of course three times as many cattle are required to consume a given quantity of food.

The approximate cost of fattening cattle on partly purchased food, at the present low prices, the cost of cotton-cake, linseed-cake, and maize at the very lowest average price delivered on farms, would amount to about 7*l.* per ton.

PRESENT ASSUMED COST OF FATTENING CATTLE PER HEAD PER WEEK.

Dr.	£	s.	d.	*Cr.*	£	s.	d.
8 lbs. cake and meal per day, ½ cwt. per week, at 7*l.* per ton	0	3	6	8 lbs. meat, at 8*d.*	0	5	4
1 cwt. clover or hay, at 3*s.* 6*d.* per cwt . . .	0	3	6	5 cwt. dung, if in boxes, cost	0	4	8
1 cwt. litter, at 6*d.* per cwt.	0	0	6				
3½ cwt. roots, at 5*d.* per cwt.	0	1	6				
Interest, attendance, &c. .	0	1	0				
	£0	10	0		£0	10	0

The dung at this rate would cost 18*s.* 8*d.* per ton.

A hundred and eighty head of cattle, fattened at this rate for twenty weeks, would cost for dung during a winter the large sum of 840*l.* If all this dung were applied to the root-crop, the cost would amount to 14*l.* per acre. If 840*l.* stood for all the arable land, the cost per acre would come to 3*l.* 10*s.*

The cattle fed on roots and straw alone would produce 600 tons of dung or so, neither hay nor clover being used. This poor dung, at 5*s.* 9*d.* per ton, only amounts to 172*l.* 10*s.*, or 667*l.* 10*s.* less than the cost of the purchased and dear food manure. If, therefore, 200*l.* were spent on purchased artificial

manures to supplement the poor dung, equally good crops might be obtained as by depending wholly on rich, but too dear, dung. It may easily be remarked: But who would go such ridiculous lengths as to attempt to fatten 180 head of cattle on a small farm; one half as many would be quite enough, and the rest of the roots might be consumed by sheep? The reply to this is, that the land is not suited for treading by sheep. Further, if it is supposed that half a dozen old cows, placed here and there in corners, and fed frequently at a cost of 15*s.* per week, are useful as manure makers, why should not the system pay equally well, or better, on a larger scale? An ordinary farmer may be able to afford to keep a few oil-cake feeders, but he would be an extraordinary farmer who would increase his cattle from 60 to 180, without finding out that his system was too costly, and an extra capital of 3,000*l.* or so required.

My present system of farming is to aim at keeping up the manurial condition of the land, so that it may produce good crops at the smallest cost for manure. For years past, my main reliance has been placed on artificial manures. Some dung is made and some bought, but it is found to answer best, as a rule, to sell hay and straw and purchase manures. The land is barely second-class, but for all this, in suitable seasons, the crops have certainly been better than the crops of those average farmers who mainly depend upon dung. Profits on an average over thirty-three years would be considered fairly good by most people. In parts of half a dozen fields, no dung has been applied for about forty years. On the parts entirely manured by artificials, the crops, save on one part of light sandy soil, are quite as good as on the parts dressed with dung. The yield of wheat averaged fully 4 qrs. over twenty years. Every kind of crop, excepting the seeds, is annually manured with either nitrate of soda, dissolved bone superphosphate, mineral superphosphate, or a mixture of all. The land was never rich, nor is it rich now, as when any portions are left (as some are every year) without any manure, the yield of corn is a good deal under what is manured. Parts left without any manure for either mangolds or swedes showed a miserable crop of only about two tons per acre. The cost per acre for manure of all kinds for the 240 acres of arable does not now amount to more than 360*l.*, or 38*s.* per acre. All kinds of artificial manures are now much cheaper than they were some time ago. The manures used on this farm are bought at one third less money than they once were.

Many experiments have been tried from time to time, and some of them are reported in the 'Journal' by the late Dr.

Voelcker. For several years potass was applied to all kinds of crops, but without any sign of doing good. Nor have silicates been found of any advantage. The main principle now is to obtain nitrogen in the most useful state at the lowest cost, together with superphosphates of known standards.

Excessive quantities of manure have not paid their way by the increase of crops over such parts as have only received moderate manurings. One year I applied a ton an acre, on four acres, of special dissolved bones, and on two acres 2 cwt. of guano in addition. Other acres were manured with quantities of 10 cwt., down to 5 cwt., per acre. The crop of mangolds was by no means in proportion to the amount of dressing, and although the succeeding corn-crop was rather better after the heaviest manuring, it was not so much in excess as to cover the extra expense of the manure. Very large quantities of dung, such as 30 to 40 tons per acre, very seldom pay. The medium way with manures, as with many other things, appears to be the safest course.

The weather and seasons influence very greatly, as a matter of course, almost every farming operation, not only with manures, but almost equally so with the due preparation of the land. Heavy and continuous rains frequently play sad mischief with the crops. For instance, in the wet season of 1879, almost all kinds of crops suffered very much, whether on light or heavy soils—particularly on clays. Nor did it appear that either dung or any kind of artificial manures exercised any particular influence over the crops. The average yield of wheat on this farm was only 17 bushels; at Woburn, after dung, under 19 bushels; and at Rothamsted but 16 bushels, after a long-continued annual dunging of 14 tons per acre. Some of the artificially manured plots at Rothamsted only produced 16 bushels, whereas the same plot had, in a favourable season, produced 53 bushels.

For nearly forty years the best artificially manured plots at Rothamsted, as have been already alluded to, produced about 3 bushels more wheat per acre than the land that received 14 tons of dung annually. The dunged land has of course a great deal of unexhausted manure in it; but, so far at least as the growth of wheat is concerned, the latent power of the soil has exercised no extra influence upon an increase of crops, and therefore offers no encouragement to ordinary farmers, who are so much more interested in obtaining a profit out of the land as they go on, without making the land poorer, than in feeding the ground with dung and obtaining no interest for the outlay.

Silicates of various kinds, and the sulphates of soda, magnesia, &c., do not appear to have done much good as manures.

There is still, however, a very large field of inquiry open to such as take an interest in these matters. I have merely glanced at a few points which may interest some who do not care to go into minute chemical questions of an elaborate kind.

It can scarcely be expected that any one could be very successful with artificial manures, unless he knew a good deal about them. He must know what kinds of manures are required for different crops, how to get the manures genuine at the smallest cost, and then learn how to apply them, in proper quantities, in a proper manner, and at the proper time.

Surely manure dealers of a certain class who offer phosphates at 1*l*. a ton have not much belief in the wisdom of the farmer. There are great quantities of what are called artificial manures offered to farmers, which are almost worthless. No one, therefore, should blindly buy what he knows nothing about.

A hundred years ago there were none of the manures commonly used now. At that time, if the land was to be enriched, there was scarcely any alternative but to make dung—rich dung —by consuming the chief produce of the farm, with the addition of oil-cake, corn, &c. At the present day we have artificial manures of every kind, and the great object of this paper is to show without prejudice, by evidence, under certain circumstances, whether it is more profitable to make dung or buy manure.

From the annals of the Board of Agriculture I have found some records of fattening cattle and sheep at Woburn nearly a century ago. These experiments, however, were not carried out so completely as the Woburn experiments now are. One trial at Woburn in 1797 was for the object of comparing the rate of increase of seven different breeds of oxen. The trial was continued for about 55 weeks. The beasts were weighed at the commencement and finish of the trial. Very little artificial food was given, only about 450 lbs. of oil-cake to each beast; about the same weight of hay, and nearly 30 cwt. of turnips. The rate of increase was very small, only 4 lbs. per week on an average. The greatest increase of the lot was a Devon that made an increase of 6 lbs. a week. Some Herefords did not increase half as much. To say the least of it, such an account as this proved nothing but that all the beasts throve very badly indeed, and must have had short rations during some periods of the trial.

Another account gives the amount and kinds of food consumed by an ox during two months:—

	£	*s.*	*d.*
3,120 lbs. turnips, at 4*s*. per ton	0	5	6
232 cakes at 12*l*. a thousand	2	15	8
775 lbs. of hay at 5*l*. per ton	1	14	6
	4	15	8

There is no record of the rate of progress in fattening; but it is clear enough that, without charging anything for litter, attendance, and interest, the cost per week would be about 12*s*. Assuming that this beast made 8 lbs. of meat, what would the cost of the dung be? Thirty shillings per ton, at the least, or fully more than the dung has cost in connection with the present Woburn experiments.

It is a good thing for the community that so many people of large means are ever ready to take a lead in making experiments, at their own cost, as to what plans may be followed and what may be avoided. There is a vast difference, however, between a practical and a merely experimental farm. The chief aim of most farmers is to make a profit. This is the kind of example and experience we all wish for. Farming of various kinds includes a large number of problems, all of which have to be worked out separately. Yet, all must work together to a great extent, otherwise the business cannot be successfully carried on. If this paper should be the means of encouraging enquiry amongst young farmers, it will not have been written in vain. It appears likely enough that subjects for discussion will not be scarce for another century or two, so that those who follow us may still have plenty to do before all are agreed on any one point.

VI.—*Recent Experiences in laying down Land to Grass.* By JAMES A. CAIRD, Northbrook, Micheldever, Hants.

GREAT BRITAIN is naturally adapted by climate to the position of a grass-growing or pastoral country, and in former times, before the high prices for wheat caused by the long wars at the beginning of the century, it is probable that a very much larger proportion of the cleared land was in permanent pasture than is now the case. Transport was very difficult, even so recently as a hundred years ago; therefore we may assume that most of the corn grown was used in the immediate neighbourhood, and that all the land not required for arable cultivation was in grass. Until the population began to increase there was no inducement to break up fresh land, experience having taught that a good old meadow could not easily be replaced. However, when the natural scarcity, caused by long wars and neglected cultivation, sent up prices, the temptation was too great, and grass lands were ploughed up to grow wheat.

Unfortunately there are no statistics to prove to what extent this was done, but there is no doubt that vast areas of poor down and heath land, in the south of England, were converted to

arable at the beginning of this century—land that cannot be tilled profitably now, and that cannot be restored to its former condition within any reasonable limit of time, if ever.

Hence it would appear that if the cultivated ground is being at the present time gradually converted to pasture, it is only being brought back to its earlier state, and nothing wrong is being done. But it must not be forgotten to what extent the condition and numbers of the population are altered. Before this century we were able to feed ourselves, we were even at times exporters of agricultural produce, whereas now we are importers of every sort of food. Of wheat alone, we only grow about one-third of our annual requirements.

Some tables at the end of this paper (pp. 154 and 155) show the changes that have occurred in the last decade, the figures being taken from the Agricultural Returns. Close upon two million acres have been added to the permanent grass lands of Great Britain in the ten years, an increase of fourteen per cent. It may be reckoned that 1*l.* an acre represents the diminished cost of labour on the land converted to grass; so 2,000,000*l.* per annum, a sum that would support 50,000 families of five persons each, or 250,000 people, has been lost, or, more correctly, has not been produced by the land. The tables also demonstrate that there is an actual falling-off in the quantity of produce in the period, in England alone, of the value of 4,935,542*l.* This is found by taking the value of all sorts of corn, including straw, and of cattle, sheep, and pigs, at present prices, for both 1877 and 1887: the cattle, sheep, and pigs together giving an increase of 3,362,481*l.*, and the corn a decrease of 8,298,023*l.* Had the calculations been based on the prices current at the two dates, the apparent loss would have been ten times greater.

In the Agricultural Returns there is a very interesting table, comparing the acreage of crops and grasses in the grazing counties and the corn-growing counties of England. Here the relative increase of permanent pasture is, as might have been expected, greatest in the grain-producing division, being fourteen per cent. in the grazing and eighteen and a half per cent. in the corn-growing districts during the ten years. Evidence is thus given of the experimental nature of much of the new grass land. It has been allowed to fall down to grass, or it has been sown down to grass, because it has been found impossible to cultivate it remuneratively in the face of the great recent fall in price of cereals. A return to a higher level of values would, in all probability, cause a reconversion of this so-called permanent pasture to arable land; but in the meantime, while the newly laid down land is struggling to assert its permanency, there is a loss of producing power, as shown by Table No. IV.

at the end of this paper (page 155). The grazing counties disclose a slightly higher percentage of increase of rotation grasses and clovers than the corn-growing counties, the moister climate enabling the farmers to leave the land under these crops a year or two longer than it can be left with the smaller rainfall of the eastern coast.

With the object of obtaining independent evidence from practical men engaged in agriculture, the following list of questions was sent out by me, and was well and ably responded to. The answers from the eastern, or corn-growing counties, are placed first, followed by the replies from those counties in the mild and moist west, naturally suited to the growth of grass.

Schedule of Questions.

1. What is the nature of your soil and subsoil?
2. Is drainage necessary; if so, was the land drained before sowing the grass?
3. What is the annual rainfall and character of the climate?
4. What seeds were sown; was it a seedsman's mixture for permanent pasture, or a selection of your own?
5. Did the seeds include ryegrass; if so, in what proportion?
6. Was the grass sown with or without a corn crop?
7. Are you in favour of spring or autumn sowing of seeds?
8. As a general rule, what has been your treatment of the new grass land with regard to pasturing it with cattle or sheep, cutting it for hay, and manuring?
9. Where ryegrass was included in the seed mixtures, have you noticed whether or not it disappeared in the course of a few years?
10. Where permanent pastures in the early years of their establishment have been used for feeding sheep, has there been, as a result, any diminution in the clover plant?
11. How many years do you consider it takes to form a good permanent pasture?
12. Have you had any experience of the result of land being allowed to form itself into pasture without seeds being sown?
13. Where a large area of land, previously cultivated, has been laid down to permanent grass, is there a noticeable reduction in the population of the district?
14. Might it not be better to let the land remain three, four, or more years in grass, rather than lay it to permanent pasture?
15. Please add any general observations on other than the foregoing heads which may occur to you.

Amongst the more important answers received to my Schedule of Questions were the following:—

Mr. ALBERT PELL, *Hazelbeach, Northampton.*

1. Heavy, sticky. Boulder clay with some oolite in Northamptonshire. Gault in Cambridgeshire.

2. The land was drained; some of it more than once before laying down. Drains 2½ feet to 3 feet, but 10 feet to 16 feet for springs.

MR. ALBERT PELL—continued.

3. On Northamptonshire farm 29 inches, average twenty years. On Cambridgeshire farm 22 inches, average twenty years. Northamptonshire farm 584 feet above sea; rather moist, warm nights. Cambridgeshire farm 20 to 40 feet above sea. Climate continental; hot bright summer, cold winter.

4. My own mixture, seeds bought and delivered in separate parcels, frequently tested in pots. I never buy of an advertiser.

—	lbs. per acre				—	lbs. per acre			
	1884	x	1886	1879		1884	x	1886	1879
Cowgrass	2	1	2	$2\frac{1}{2}$	Crested dogstail	—	1	2	1
White clover	6	4	5	4	Sweet vernal	—	1	1	1
Alsike	2	2	2	1	Poa nemoralis	—	1	1	1
Trefoil	1	4	3	$1\frac{1}{2}$	Rib grass	2	2	2	2
Timothy	4	2	3	2	Pacey's perennial ryegrass	10	16	14	16
Cocksfoot	4	4	4	4					
Sheep's fescue	2	1	—	1	Italian ryegrass	4	4	—	4
Poa pratensis	2	1	1	1	Meadow fescue	—	2	2	2
Poa trivialis	2	1	1	1	Red clover	—	1	1	1

5. I shall not abandon a "pinch" of Italian ryegrass.

6. With a spring-sown crop.

7. Spring sowing has been my invariable practice.

8. Graze after corn harvest (*i.e.* the year of sowing) lightly with young stock among the stubble. Next year, mow once, graze aftermath with sheep, no manure. Second year, graze with young cattle and some ewes and lambs, lightly these. Third year, graze with cattle in spring, and heavy with sheep during summer. Fourth year, frequently mow, and graze aftermath immediately with sheep heavily.

9. The Pacey seems permanent. Italian, of course, dies out, but sometimes specimens last four years, perhaps seedlings.

10. I never have stocked heavily in the early years with sheep, but I do not think this would do much harm to white clover, provided it is not trampled during frost.

11. Depends entirely on the way the seeds hit, and on the subsequent rainfall. The plant ought to be good and have the main characteristics of permanent pasture on my land in less than ten years.

13. Undoubtedly, unless a manufacturing population is introduced, frequently the case in the Midlands, or unless fruit is grown, as in Cambridgeshire.

14. In many cases it might, on loams not over rich (3-horse land). I do this myself now, and shall increase the area so treated unless prices of grain, especially oats, rise materially. When seeds are over their second year, I endeavour by careful grazing not to let them "run away," get hearty.

15. I consider it of much importance to buy the seeds in separate parcels and to test them, also to keep to the same seedsman if the tests turn out well. On my land it is of importance to have the surface fine, and to brush harrow seeds well in if you do not drill. In drilling seeds, I drill clovers one way and then cross them with the grass seeds. Lime helps seeds. I consider it desirable to sow early, not now fearing the frosts of spring so much as the droughts of summer. In order to secure early sowing of seed, I broadcast my corn directly the dirt does not cling to the shoe, and follow at

[*For Schedule of Questions, see page* 126.]

MR. ALBERT PELL—continued.

once with the seeds and brush harrow. Thus I have a good plant this dry year. Red clover is not to be relied on on my Northamptonshire farm. In Cambridgeshire (greensand and gault) it never misses, but 4 lbs. is enough for permanent pasture; and a remarkable thing is, that in Northamptonshire farm sowing 4 lbs. red clover with the other seed all seems to hit and stand, but sowing 12 lbs. to mow all seems to go off.

Mr. JAMES HOWARD, *Clapham Park, Bedfordshire.*

1. Boulder clay.
2. Yes; drained 36 inches to 42 inches deep. Drains 21 feet apart.
3. Rainfall, 25 inches. Climate, tolerably mild.
4. Seedsman's mixture; but I bought half of one eminent seedsman and half of another, and mixed the two; I have found this a safe and good plan with grass as well as with other seeds. I have always been successful in getting a plant since I adopted it.
5. A little ryegrass came up.
6. I have sown down to grass some 300 acres; I commenced by sowing down with a corn crop, but when corn fell to a low price I was led to abandon the practice, and I sowed upon bare fallow. Some of my best pastures were summer-fallowed for two years in succession, and with clay land out of condition I should again adopt this method. Latterly, with my land in good condition, I have sown it down with sainfoin, and after the first or second year have sown a small quantity of grass seeds. A pasture may in this way be established without the farmer feeling the cost of laying down as he does in the ordinary way. I have tried lucerne as well as sainfoin, but the results were not quite as good.
7. Autumn. If sown in spring, when vegetation is quick, the weeds run a race with the grasses, smother a large proportion, and get possession of the ground.
8. As far as the exigencies of the farm permitted, I have avoided putting sheep upon it or heavy horned stock. If sheep were put on they were folded—the folds of ample size and moved daily. If grazed, young horned stock are best. I never mow newly sown fields, except the exigencies of the farm demand it. As to manuring, my rule is "little and often"; heavy dressings promote the growth of the coarser grasses. Farmyard manure should be evenly and uniformly spread over the surface. To effect this object, after the men have finished, I send the hay-making machine, in the forward action, over the field; this scatters the manure very evenly.
9. Disappears.
10. Yes. Except the pasture is manured annually the clover will disappear—at all events on my soil.
11. It all depends upon management. I have a small pightel on which rams and sheep for shows have been kept, and, of course, fed highly. After four years the enclosure had the appearance of an old pasture; but unless specially treated it takes fourteen years on this soil to make a decent pasture—and even then it lacks the springiness of old turf. This elasticity is of course due to the roots of former generations of grasses, which time alone will produce.
12. Not upon my own land; but an immediate neighbour allowed two fields to "tumble down" to grass. I pass them constantly, they have been down about four years, and have yielded very little keep. The grasses do not appear to be of a desirable kind, and the example is not likely to be followed by his neighbours.

[*For Schedule of Questions, see page* 126.]

Mr. James Howard—continued.

13. Clapham being contiguous to the populous borough of Bedford is no criterion as to the effect, but I estimate that half the labour will suffice for pasture where dairying is carried on, and much less than half where only neat stock is kept.

14. Not in this district; the rainfall is not sufficient, especially in spring and summer, and the district is not naturally good for artificial grasses.

15. The third or fourth year after sowing is, as all men of experience know, the critical period for newly sown pastures, and the treatment should at this time be liberal, or the grasses will die out. If, however, the soil is well treated from the commencement, and was in good heart when sown down, the vigour of the grasses will be maintained. No horses, old or young, should be turned out, and if sheep are put upon new pastures they ought not to be depastured, but folded. My practice, with both old and new pastures, is to harrow them with a flexible spiked harrow twice a year—spring and autumn. The effect is to distribute the cattle-droppings, to let in any seeds which may be upon the surface, to disturb any moss which may have formed, or rough grass which may have become matted. A little money expended on weeding during the first year will pay ten-fold.

Sir John H. Thorold, Bart., *Syston Park, Grantham.*

1. Strong clay of the lias and Oxford formations.

2. The land has all been drained within the last thirty years, but not especially for laying to grass.

3. The climate of South Lincolnshire is usually dry.

4. When I began to lay down land to grass I bought the best mixture I could get from eminent seed-merchants at two guineas an acre; but since the publication of Mr. De Laune's article in the 'Journal' I have bought the grasses separately, and with a guarantee of germination, and can show better results from the expenditure of 25*s.* per acre than from the 42*s.*

5. The seeds sown latterly did not include ryegrass. The bought mixtures contained an excessive quantity.

6. I have sown down both with and without a corn crop, and with rape. I think in practice a light corn crop does little harm and helps to pay expenses.

7. Spring sowing. I have sown four times in the autumn, and have only once secured a good plant.

8. I have depastured the young grass with sheep and young cattle in the next autumn and the following year, but have not mown it excepting that were necessary. I have run the machine over it to check the annual weeds, and have left the cut grass upon the ground. I have eaten cake upon it, and manured with sulphate of ammonia and superphosphate of lime and with malt-kiln dust.

9. The ryegrass has either dried away or become very weak. The seed stalks seem to be avoided by all stock when hard.

10. The red clover seems to die out after the second year, whatever the treatment may be. We have a red clover in our lanes and in some of our old pastures which I believe to be permanent.

11. This depends very much upon the soil, the climate, the amount of manure, and the amount of seeds sown. In this climate, with plenty of manure, or with cake eaten upon the land, eight to ten years are required to make a good pasture.

12. I know of several fields which were allowed to fall down to pasture

[*For Schedule of Questions, see page* 126.]

SIR JOHN H. THOROLD—continued.

about forty years ago and are now good pasture, and of others of about the same age which are very bad and seem never to improve.

13. So far, that has not happened in this district. A great deal of grass was ploughed out when corn-growing was profitable, and what has been laid down will not do more than restore the previously existing proportion between arable and grass. The population has not been reduced, but work is scarce, from unprofitable seasons and failure of the turnip crop.

14. Not upon the strong clays, as the expense of properly cleaning the land again would be great.

MR. W. H. HALL, J.P., *Six Mile Bottom, Newmarket.*

1. The soil on which I have laid down pasture has varied from a light to medium sandy loam, with a subsoil of upper chalk, to a stiff boulder clay with similar subsoil.

2. Only in the latter case the land was drained before sowing.

3. The rainfall is very low, ranging from 15 to 20 inches. Very drying winds prevail, rendering the climate generally most unsuitable for pasturage. We are largely dependent on stored water, which we catch off roofs in tanks, or from the watercourses in flood-time.

4. My seeds were generally a seedsman's mixture obtained from Sutton.

5. They did include ryegrass, except on one piece, which was mainly sown with cocksfoot, meadow fescue, and Dutch clover.

6. Generally with a crop.

7. I have always sown in spring, because of sowing with spring crop, except on a very small garden plot, which was sown with excellent result early in September. I think early autumn sowing would answer best, because of our dry cold springs.

8. I graze first crop and cut for hay, alternately, and graze with store cattle and sheep alternately. Our second crop is hardly worth mentioning, as our summers scorch the pastures three years out of four.

9. The ryegrass, I believe, generally disappears.

10. I think not.

11. I have not got one yet, after trials varying from fourteen to four years.

12. Yes, if there is a difference, I should give it in favour of the pasture without seeds, where it has been freely grazed.

14. I think it might, relying mainly on ryegrass and red clover.

MR. JAMES STRATTON, *Chilcombe, Hants.*

1. Chalk subsoil; the soil being in some cases very light, in others red and very strong.

2. No drainage was necessary.

3. About 33 inches.

4. One bushel Italian, ½ bushel perennial ryegrass, 6 lbs. timothy, 4 lbs. Dutch; but if the land was fresh to broad clover, I used less ryegrass and 8 lbs. of clover, which gave a greater crop for the first year, which being fed off with cattle eating cake well manured the land, and so was the means of establishing the permanent grasses, which were little seen at first. This seeding would, if required, also cut a good hay crop the first year, which would be worth a good bit of money and so pay for the cost of seeding down; but, of course, mowing would delay the formation of good pasture.

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MR. JAMES STRATTON—continued.

5. Italian ryegrass helps to keep the land firm, which is essential to the growth of grass seeds, and it continues through seedings, &c., to remain in the pasture, adding much to the crop of wholesome grass.

6 and 7. I think it economical to sow in a corn crop in spring-time.

8. I recommend that only cattle should be pastured on new grass during the first autumn and winter: their treading does much good if the land is fairly dry. They should be eating cotton-cake. A dressing during the winter of fresh-made muck, made by cattle eating cake, will have established your pasture, after which you can do what you like, gradually spoil it by mowing or folding off sheep from it, or continue to improve it as I have directed. I have experienced both systems. It does not matter whether you feed sheep or cattle, but both should be eating cake.

10. I think that winter-feeding by sheep tends to reduce the clover plant.

11. One, managed as I have said.

12. I have good pasture formed from worn-out sainfoin, and also where it has been laid down full of couch. This land was naturally good, it was well fenced, and a good drinking place made, and stocked with cattle eating cake, &c.

13. Yes.

14. Yes, unless the land in question is well fenced, has a good water supply, and is conveniently situated as accommodation pasture.

15. I have laid down about 2,000 acres of arable to grass; the foregoing remarks are founded upon my experience.

MR. WILLIAM C. LITTLE, *Stags Holt, March.*

I am sorry I cannot give any information on this subject, as I have had no experience in the matter. I have this year attempted to lay down one small field, but it is too early to say anything as to the result. Very little land has in this neighbourhood been converted into pasture. Until quite recently there was a rage for ploughing up old grass lands for the purpose of growing such crops as brown mustard and potatoes, and with our dry climate there is very little disposition or inducement to lay land down for more than two or three years.

MR. CHARLES HOWARD, *Biddenham, near Bedford.*

1. Heavy clay and stonebrash.

2. All drained some years since, but a large portion tile-drained about five or six years ago.

3. About 22 inches.

4 and 5. 2 pecks perennial ryegrass, ½ peck Italian ryegrass, 2 lbs. timothy, 2 lbs. cocksfoot, 8 lbs. white clover, 2 lbs. red clover. This mixture has been frequently used in this neighbourhood, and has answered very well.

6. With a corn crop.

7. Prefer spring sowing, but have seen some good pieces sown in the autumn.

8. I believe it is better to mow the new grassland the first year. I mowed a portion of a large field the first year and grazed the remainder; there is no doubt that which was mown is better pasture than the other. I have grazed it with cattle and sheep.

[*For Schedule of Questions, see page* 126.]

MR. CHARLES HOWARD—continued.

9. I do not think it has disappeared, for the simple reason it each year sows itself.

10. I think the clover plant would diminish if fed constantly with sheep; it is a desirable practice, which I have adopted, to re-sow a portion each year with some mixed clover seeds. If fed with young cattle and not overstocked with sheep, the various grasses and seeds will sow themselves.

11. Very much depends on the soil and treatment, but as a rule from eight to ten years.

12. No; but I have heard some old farming friends say that some of the best grazing land they knew was what is called in this neighbourhood "tumble-down."

13. There is not enough laid down in this neighbourhood to cause any noticeable reduction in the population.

14. I think it would be better on very poor clay land to let it remain down to grass for three or more years, if wheat realised more money; but the working expenses of such land would beat any one, with wheat at 28*s.* to 30*s.* per quarter.

Mr. A. CURTEIS NEVE, *Holt Park, Rolvenden, Kent.*

1. More or less heavy Wealden clay; an outcrop of Hastings sand in parts.

2. Most necessary. The land was thoroughly drained 3 feet deep some few years before being laid down. A few furrow surface drains were made on the stiffest portions.

3. Average rainfall for twenty years, 29·75 inches.

	lbs. per acre		lbs. per acre
4. Cocksfoot	6	Ryegrass	6 to 6½
Catstail	6	Cowgrass	3
Meadow fescue	3	Wild white clover	3
Hard fescue	1	Alsike clover	2
Crested dogstail	1	English red clover	2

The above mixture is not a seedsman's mixture for permanent pasture, but was a selection of my own.

5. The grass seeds sown included ryegrass in the proportion of 6 lbs. to 23 lbs. grasses, or in the proportion of 6 lbs. to 33 lbs. clovers and grasses.

6. The soil not being suitable for barley, I prefer the practice of sowing with wheat or oats, and I have also succeeded with beans. I find the corn crop "pays," and it materially protects the young seeds from frosts and drought. Great care is taken to get sufficiently fine tilth, even if the corn crop is partially harrowed up.

7. Early spring I consider the best time, so as to escape the spring frosts, and early enough to get the plant well established before the hot dry summer commences.

8. The young seeds are well rolled in the spring of the next year, no stock having as yet been put on; it then had a small dressing of fish guano and was laid in for hay. The pastures are generally stocked with sheep after having been mown, till October, removing them when wet. In the second spring the pasture is again well rolled, and a dressing of 1 cwt. of nitrate of soda and 2 cwt. of superphosphate has been found very beneficial. Ewes and lambs having grains and corn are allowed on during April, after which it is laid in for a second year's hay. When the plant is well established in

[*For Schedule of Questions, see page* 126.]

MR. A. CURTEIS NEVE—continued.

its third year a dressing of eighteen loads of good dung has been profitably applied.

9. The ryegrass which was included in the above seed mixture has not disappeared as yet; and I neither expect it to, as I find a large percentage of ryegrass in many of our best permanent pastures which have been down for upwards of forty years.

10. I have not noticed any diminution in the clover plant.

11. Varies according to the character of the first two seasons after sowing. Usually it takes from four to six years.

12. I have not any personal experience of this, but I have observed in neighbouring self-sown pastures an excessive quantity of worthless grasses: agrostis vulgaris (bent-grass), bromus mollis (soft brome), holcus lanatus (meadow soft-grass), catabrosa aquatica (creeping water-grass), and carnation-grass, which are intermixed with poa trivialis (rough stalked meadow-grass), poa annua (annual meadow-grass), with a few others.

13. It certainly causes a reduction in population, but sufficient has not been laid down to make an appreciable difference in this particular district.

14. Having taken great care, and having gone to considerable expense in laying down pastures, I prefer to leave them for a permanency.

15. We occupy over a thousand acres of pasture, including some of the best fattening land in Romney Marsh; having one field which will fatten ten or twelve sheep to the acre for the summer months. During the last five years I have kept up sixty distinct plots of grasses, clovers, &c., for the purpose of watching closely the habits of these plants. I may add that a few fields which were sown down with seedsmen's advertised mixtures some fourteen years ago are now practically worthless as pastures, and we are about to plough them up and re-sow them.

MR. JOHN CLUTTON, *Whitehall Place.*

2. If the land is heavy clay, or it has suffered from the wet, it has been pipe-drained, but I do not think it necessary that the lines of pipes should be laid so close together as in the case of arable land.

4. I make a practice of selecting my mixture of seeds to suit the particular district, and have the seeds supplied by a reliable seedsman accordingly.

5. I exclude ryegrass, as I am unable to obtain with certainty perennial ryegrass, except in some few rare cases.

6. I prefer sowing without a corn crop. I have found it a good plan to sow the grass seeds with about 3 lbs. of rape-seed per acre.

7. I do not give a preference to either. The season for sowing depends much upon the circumstances of each case. I have had favourable results from autumn sowings, particularly upon clay lands.

8. I usually mow the seeds in the first year, and dress with farmyard manure afterwards. I feed with horned stock, with from 2 to 3 lbs. of linseed or cotton-cake a day each during the summer. I do not stock the land with sheep during the first three years, and I do not stock at all in the winter or in a wet season.

9. In cases which have come under my notice where ryegrass has been used, it has usually disappeared after the first two or three years.

10. Yes; and also a diminution in the finer grasses.

11. From five to ten years, if properly managed in the early years after sowing down.

[*For Schedule of Questions, see page* 126.]

MR. JOHN CLUTTON—continued.

12. I know of cases of land having formed itself into pasture, but not frequently.

14. It depends upon the character of the land. I think when grass seeds are supplied to a tenant, it might be better to supply a cheaper quantity of seed, and allow the land to be broken up at the end of a short period, as the subsequent management is seldom properly attended to. Neither is cake fed on the land usually.

15. I have, in various parts of the south and west of England, supplied grass seeds, and upon various soils, but tenant-farmers do not realise the necessity of after-management to ensure a successful permanent result. In my own case I have laid down many acres of poor clay land with good results. I have usually applied a light dressing of farmyard manure within two years of seeding down, and year by year have fed stock upon it with daily small quantities of cake, ranging from 2 to 3 lbs., never more, with favourable results both to the cattle and the land. On Wealden clay, sown down without a corn crop, with a light dressing of manure, I am enabled with 2 lbs. of oil-cake to make cattle fit for the butcher, and the grass year by year improves in abundance and quality. The time of year which is most favourable for sowing grass seeds depends greatly on the season and weather, assuming the land to be clean. Whenever a fine tilth can be obtained with a firm bottom and sufficient moisture, the seeds may be sown between April 1 and October 1, but not later.

Sir JOHN B. LAWES, Bart., *Rothamsted, St. Albans.*

1. Heavy loam, raw yellow clay, with chalk 9 or 10 feet below surface.
2. No.
3. 28 inches. Over 400 feet above level of sea. Rather cold and backward.
4. I have adopted both, with very little difference in the result.
5. Always in considerable proportion.
6. With barley, using less seed than usual for an ordinary crop.
7. Spring; unless the harvest is got in sufficiently early to enable the grass seeds to be sown by the end of September.
8. Dairy cows or cattle, no sheep. Pasture with occasional mowing, some pasture never mown.
9. Several grasses have become much less abundant; amongst them, rye-grass and timothy.
12. I have no doubt that any land without being sown will form a pasture in time; the character of the pasture will depend upon the quality of the land and the amount of manure applied. Some of my land was very full of couch grass when laid down after a third corn crop, this has been driven out under high manuring. Seeding shortens the time of forming a pasture.

(The late) MR. JOHN COLEMAN, *The Mount, York.*

1. A strong drift clay, with occasional veins of gravel; naturally of a somewhat poor nature.
2. Yes; it is quite useless either to grow grass or crops unless the surface water is removed. The country is very flat, and the surface somewhat uneven; and unless the land is thoroughly drained at from 7 to 9 yards wide, and from 30 to 36 inches deep, water will stand on the surface in low spots, and the manure will lose half its value.

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MR. JOHN COLEMAN—continued.

3. About 26 inches per annum, with cold backward springs; otherwise tolerably equable, as the farm is situated in the great valley of York.

4. A selection of my own comprising:

	lbs.		lbs.
Cocksfoot	6	Hard fescue	1
Catstail	4	Perennial red clover	2
Italian ryegrass	2	Alsike	2
Perennial ryegrass	4	White clover	2
Meadow fescue	2	Trefoil	1
Meadow foxtail	1	Cowgrass	3

5. Yes; 2 lbs. Italian, 4 lbs. perennial: such was ordered, but the extraordinary predominance of the ryegrasses in the first crop of hay led me to imagine that I had been imposed upon by the seedsman, and I accordingly forwarded a collection of the grasses in flower to Mr. Carruthers. Of course this was a very rough method of ascertaining the proportion of the various grasses in the crop. Mr. Carruthers' report was so interesting that I append it:—

	"The seeds ordered should give the following proportion of germinating seeds. Per cent.	The sample of the crop examined gives the following proportion of plants. Per cent.
"Perennial ryegrass	6	55
Italian ryegrass	3	7
Red clover and cowgrass	8	19
Alsike	9	5
Trefoil	2	5
White clover	8	4
Timothy	30	1
Black grass	0	3
Yorkshire fog	0	1
Cocksfoot	23	0
Meadow fescue	3	0
Hard fescue	4	0
Foxtail	4	0
	100 seeds.	100 plants."

6. The grass was sown in a crop of wheat which was not very thick on the ground. The spring was very favourable for growth, and after the corn was removed, the surface was found to be very thickly covered with clover and grasses. The seeds were drilled across the corn by a small seed-drill which places the rows about 4 or 5 inches apart.

7. On soils and in a climate such as I am describing, I am quite sure that spring sowing in a moderately thin corn crop is decidedly the best plan; as the young seeds are sheltered from drought, and risk of frost is avoided.

8. In this particular case, the seeds were so luxuriant that a crop of hay, over 2 tons per acre, was made, and a second crop was cut in August for silage and green food for the horses. As far as I can judge, this treatment, severe as it appears, was not injurious on this strong land, probably resulting in a larger root-growth than would have been the case if the seeds had been grazed by sheep. If the soil had been of a light nature, I should most certainly have preferred grazing the seeds with lambs and young cattle, and in the autumn of the second year applying a dressing of well-made farmyard manure, carefully spread. In the spring of the second year the field was divided into two equal portions, one half was grazed by

[*For Schedule of Questions, see page* 126.]

MR. JOHN COLEMAN—continued.

shearling sheep, horses occasionally, and later on by cattle. The sheep and cattle were liberally fed with cake, &c. The other half was dressed with 5 cwt. per acre of soot, and mown for hay, and afterwards grazed. The yield was, owing to the dry season, about half the previous crop; principally grasses, but very little clover, the latter not destroyed apparently, but small in growth. At the present time that part which was grazed appears to have made the best progress, as it is knitting together very nicely. The whole should now receive a suitable dressing, either of fold-yard or artificial manure, the latter to be given in early spring.

9. There was a great diminution of the ryegrasses after the two mowings described above, and cocksfoot, meadow foxtail, and some catstail took their place to a large extent. At the same time I think it hardly possible that the extraordinary luxuriance of the first year could have existed, if the Italian and perennial ryegrasses had only been in the proportions ordered. I am decidedly of opinion that where the first crop is intended to be mown, a small proportion of ryegrass is advantageous.

10. This entirely depends upon the manner in which the sheep are fed. If stored sheep are thickly stocked upon young seeds, without any artificial food, and only the pasture to support them, there is very great risk of their gnawing into the heart of the clover plants, and so causing their destruction; but if lambs only are grazed, and they are supplied with artificial food, we believe that in many cases their influence is beneficial in producing a sward.

11. On land that is in high condition, clean, and suitable for grass, on the western coast, good grass is often formed in five years; whereas in the dryer climate of the east, double this time is usually required to make a close thick sward, and that only by a judicious and liberal treatment.

12. Yes. If allowed to fall down with weeds, it has been an utter failure; but in certain soils in Leicestershire, which are naturally adapted for grass, if the land is clean, natural grasses will soon cover the surface and rapidly make pasture.

13. Most certainly. We know of large farms in Wiltshire which formerly employed five or six hands, which now, being all grass, only require a shepherd and a cattle-man. The wholesale carrying out of this system must largely depopulate any district in which it occurs.

14. This entirely depends upon the soil. On the light soils of the New Red Sandstone, there is no doubt more stock food, in addition to the corn, can be obtained by this alternate system of husbandry; and this more or less applies to all the lighter soils that are not suited to permanent grass. We know of farms in Cheshire where there is no permanent grass at all, the seeds remaining down five or six years; and yet, by dint of liberal treatment, as much cheese is produced as on the best dairy farms in the country. In our opinion the process of laying land down to grass has gone quite as far as is practicable.

15. I should like to express my opinion as to the utter uselessness of sowing renovating seeds on neglected pastures. Such outlay is, as a rule, entirely wasted, inasmuch as the seeds seldom, if ever, grow, and, however bad the pasture may appear, there are always good grasses and clover to be developed by the use of suitable manures.

Mr. G. MANDER ALLENDER, *Stammerham, Horsham, Sussex.*

1. Wealden formation, generally, but contains large percentage of silica under some portion laid down. Stone is found two to three feet below surface,

[*For Schedule of Questions, see page* 126.]

Mr. G. Mander Allender—continued.

2. Drainage is desirable, and has been carried out to a considerable extent by means of steam mole drainage.

3. Climate dry.

4. In all cases my own selection: varying according to position of field and requirements. Cost from 25*s.* to 45*s.* per acre.

5. Always some ryegrass, varying as above in quantity.

6. Some with, some without.

7. Provided suitable weather and necessary condition of land, I have no preference.

8. Generally cut for hay. Sometimes pasture with cattle, never with sheep. Assist, with guano, fish-manure, or dissolved bones, unless I can dress with peat-manure, applied direct from the cattle-houses.

9. I have not any recently laid down land older than three seasons. I believe that the ryegrass will not disappear.

10. Do not put sheep on newly laid down grass—indeed, seldom have sheep "out of the hurdles."

11. Entirely depends upon condition of land when seeds are sown, subsequent treatment, and quantity of seed used. I have some pieces only down three seasons which are rapidly becoming "good permanent pasture."

12. There is one field on the farm which I am informed "fell down" about six or seven years ago. It is now a fair pasture, but for the last two years it has been heavily manured with "farmyard," and has been dressed with dissolved bones; last year it had a few seeds sown upon it. I have another piece which was foul when entered upon four years ago. Some clover was sown, and it was folded over twice, the sheep getting plenty of cake, and as many cabbages as they required. It is now a very useful piece of grass.

14. Not for my purpose; I have put down about 250 acres in the course of arranging a number of small farms so as to make one occupation.

15. I believe that the great difficulty in laying down land to permanent pasture is the attempt to do so at too small a cost. I always add a few seeds each year to newly laid down land, at a cost of from 5*s.* to 7*s.* per acre, and adopt the same plan on inferior natural grass.

Mr. Reginald A. Warren, *Preston Place, near Worthing.*

1. Deep loam on a subsoil of chalk, met with from 5 ft. to 15 ft. from the surface. My farm is on the flat, between the South Downs and the sea.

2. No. The land is sufficiently drained by earthworms.

3. Being close to the sea, the winters are mild. The summers are generally dry and rather trying for grass land.

4. Seedsmen's mixtures.

5. The first experiments included ryegrass, but I prefer it without, and of late years have not sown any.

6. Always in thin sown corn crops.

7. I prefer sowing early in spring. If sown in autumn, the winter is apt to destroy the finer grasses.

8. Mow the first year, and feed with cattle afterwards. If horses or sheep are turned on before the third year, they seem to pull up much of the finer grasses. Most arable land when sown down is at a lower standard of fertility than old pasture, and seems to require bone manure and other liberal treatment.

9. Yes; leaving small patches where it grew, which became mossy if not manured.

[*For Schedule of Questions, see page* 126.]

MR. REGINALD A. WARREN—continued.

10. Clovers disappear on the permanent pastures here, but I do not attribute that to feeding with sheep.

11. Not less than seven or eight years even with liberal treatment. If not well cared for and manured, perhaps fourteen or fifteen years.

12. Not in this district; but I have watched the process on poor brashy land and sour clay in the Cotswold district, and have seen better pasture come than one would expect.

13. Yes; when the area is extensive, but it is not noticeable here.

14. No doubt it is better where good pasture cannot be obtained; but when broken up again it must be very foul, and perhaps full of wireworm, until it is time to seed it down again.

15. The old pastures here consist of strong, deep-rooted grasses chiefly. No clover, cocksfoot, or ryegrass is found. This is attributable, I think, to the ground becoming hard and dry in summer. The land is first-class wheat land, but the grass land does not yield correspondingly heavy crops. The herbage, however, whether fed off or made in hay, is very sound and nutritious. Many years ago an 8-acre field sown with permanent grass seeds (in which ryegrass was mixed) came up very strong, and I folded it over closely with sheep in May the first year with very good effect.

MR. CLARE SEWELL READ, *Honingham Thorpe, Norwich.*

1. A stiff loam, resting on a clay or brick-earth subsoil.

2. Some of the land when in arable cultivation was drained many years ago.

3. About twenty-five inches; climate dry, and this farm seldom catches any thunder rain or showers in a drought.

4. Mixtures from Messrs. Sutton & Sons, Reading.

5. Yes, but the proportion I do not know.

6 and 7. A portion of the root crop was folded early in the autumn and drilled with wheat nine inches wide. In the spring the wheat was horse-hoed, and the seeds sown and harrowed in and rolled down. I am sure this is the best method of sowing grass seeds in the Eastern counties. If without a corn crop, the annual weeds smother the seeds. If sown with spring corn, the soil is either too cobbly or too loose, and some seed is buried too deeply, and some never grows. With autumn wheat the land becomes consolidated, the horse-hoe raises enough fine mould to cover the seeds, and there is a fine friable well-consolidated seed-bed, which is what the young grasses delight in. Wheat stands up better than barley or oats; they often lodge and kill or smother some of the seeds. I have never known success attend autumn-sowing of seeds. Often the winter kills the most delicate plants, and I have seen all the seeds lifted clean out of the land by frost and destroyed. I have seen permanent grass seeds sown with rape; but then the rape should not be fed, but mown green, and used for fodder upon another field or in the yards. The stalks are, however, often a nuisance in the following year.

8. I mow the seeds the first two years, and as soon as the hay is off apply a good dressing of farmyard manure and mould (a sort of compost of any refuse and scrapings), and when the second crop is well up, stock with cattle. Every other year, until the seeds are ten or twelve years old, they have been dressed with a compost, but this could not be done where any great extent has been sown.

9. Ryegrasses add greatly to the bulk of hay in the first two years, and

[*For Schedule of Questions, see page* 126.]

MR. CLARE SEWELL READ—continued.

then gradually disappear. A moderate quantity of ryegrass does not seem to injure the more permanent grasses, and it certainly is of great advantage to the hay-crop, and pays the farmer.

10. I never feed young grasses with sheep, save running the ewes over them in the winter to crop off any rough grass. I like to stock young grasses with cows or young cattle eating decorticated cotton-cake.

11. At least twenty in Norfolk.

12. I have seen a good deal of land that has "tumbled down" to grass—*i.e.* land gone out of cultivation, without any grass seeds being sown upon it. After the first year the annual weeds disappear, and in a few seasons the dock and thistle seem worn out. Then the foul grasses take possession of the land, and afterwards they appear to give way to better grasses, which in time produce a little decent feed. But such fields cannot make a pasture in a generation, if they ever do.

13. Where the new grasses are devoted to grazing and rearing stock the population is almost banished; it is even sensibly diminished when arable land is turned into pasture and stocked with cows.

14. I have long contended that upon our heavy and light lands it would be well that mixed seeds should lay two years instead of one, certainly in these depressed times, if not always. The third year the best seeds generally die off, and if the land is given to natural grass it becomes fearfully foul.

15. It seems a hopeless and almost impossible task to convert much of the arable land of East Anglia into permanent grass. It is a thousand pities that so much of our sheep walks, heaths, and warrens were broken up years ago. The soil is so sandy and poor, that no sort of grass will grow upon it for more than a year or two. It dies off, and the land is left as bare as the sand on the seashore. A better class of land, with a calcareous subsoil, produces good sainfoin, and this invaluable plant should be kept down for years, instead of being, as it generally is, ploughed up at the end of twelve months. Lucerne is grown in patches as a fodder crop, but there is no reason why a very much larger extent should not be sown for hay and feed. It will flourish upon all moderately light and loamy soils, will resist drought, and will stand for years; and when the plant is running out, the harrows, or even a scarifier, may be used, and permanent grass seeds sown; this is decidedly a cheap way of forming a pasture.

MR. ROBERT A. ELLIOT, *Clifton Park, Kelso.*

After having tried every known system of laying down, I have come to the following conclusions:—

That for climates like those of Roxburghshire the safest plan, both for avoiding risk from drought and frost, and certainly as economical a plan as any other, is to lay down with a thin seeding of oats or barley, and leave a very long stubble to protect the plants from the autumn and winter frosts. No stock should be put on after harvest, and none the following spring. In this first spring all blank places to be seeded. Men, with handrakes, to scratch and seed vacant spaces will cost about a shilling an acre. This reseeding is most important, not only to fill land with grass, but to exclude weeds and worthless grasses, which would otherwise get in and spread through the pasture. Then take a crop of hay, and graze aftermath with young cattle or lambs. In the year following graze in early part of season with young cattle only, as grazing in spring with sheep is adverse to the closing up of the pasture. Some sheep may be put on later in the season.

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MR. ROBERT A. ELLIOT—continued.

Reasons for haying first year.

I. It prevents injury from cropping.
II. It gives an opportunity for seeding up vacant spaces, which, when resown, will be sheltered by the grasses as they grow up for the hay crop.
III. It enables the grasses most fully to extend themselves above and below ground.

The injury caused by cropping grasses before they have perfected their growth and got a firm hold of the land is far greater than is generally supposed. If plants are not torn up, which they often are, the roots are disturbed, and much ruptured, and the plant is very liable to be thrown out by frost, and will also suffer more from drought.

Though I have decided that laying down with a crop in the manner aforesaid is the safest plan, I am of opinion that good and clean pastures may be made on any system of laying down if—

I. First-class seeds of kinds suitable to the soil and climate are put down.
II. If the land be not stocked either till after a crop of hay has been taken, or till about the time that the plants have begun to throw up their flowering stems in the summer following laying down.
III. If in the spring following laying down blank spaces are reseeded.

To laying down without a crop the objection is, that you must either injure your grasses with grazing or lose your rent. Before laying down it is important to break up (not turn up) the subsoil as deeply as possible.

It is a common idea that you must enrich your land before laying down. I have found this to be an error. The richer the land is, of course, the better; but I have found that land being in poor condition is no obstacle to laying down, as long as you subsequently enrich the land in any way most convenient.

MR. MARK J. STEWART, M.P., *Ardwell, Wigtonshire.*

1. Ardwell, in Wigtonshire.—Light sandy land, black top with clay subsoil. Much of the land is only from 4 to 8 inches deep till you get to till and stones. Southwick, in Kircudbrightshire.—The land is heavy, or light, and much mixed with granite grit.

2. Yes, generally; but much of the land is only stone-drained, and has been done forty years. It has not been specially drained for grass.

3. Average of last eight years, 34½ inches. Climate damp, mild, very little frost, and showery.

4 and 5. The best seeds that could be procured, all subject to the analysis of Mr. W. Carruthers, F.R.S., Consulting Botanist to the Royal Agricultural Society. One year (1883) I tried Mr. Faunce De Laune's mixture as per article in Royal Agricultural Society's 'Journal,' Part I., No. 35, 1882, p. 261—but no cowgrass, and 2 lbs. of Yarrow instead of 1 lb. Many varieties of mixtures have been used. My young grass at Ardwell and Southwick annually exceeds 100 imp. acres, and is all carefully sown with different mixtures.

Some of the best I find are the following:—

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MR. MARK J. STEWART, M.P.—continued.

	(1) lbs.	(2) lbs.	(3) lbs.	(4) lbs.
Cocksfoot	5	7	7	8
Timothy	4½	3	3	3
Meadow fescue	4½	3	3	2
Tall fescue	2	1	1	2
Cowgrass	2	3	3	3
Alsike	2	2	2	2
White clover	2	2	2	2
Red clover	2	0	0	0
Ryegrass	27	2	18	0
Italian ryegrass	4	4	0	0
Meadow foxtail	0	1	1	1
Hard fescue	0	1	1	1
Dogstail	0	1	1	1

Others I tried with 6 lbs. ryegrass and 4 lbs. Italian, also 18 lbs. ryegrass and 4 lbs. Italian. In early spring the ryegrass and Italian show best; in later summer the natural grasses.

After potatoes the best result I have had, sown on August 25, was sown with the first of the following mixtures. This year I have tried to improve as shown in the second mixture:—

	(No. 1.) lbs.	(No. 2.) lbs.
Meadow foxtail	6	3
Cocksfoot	12	10
Meadow fescue	4	8
Tall fescue	2	6
Rough-stalked meadowgrass	1	0
White clover	4	3
Timothy	4	3
Dogstail	—	¼
Poa nemoralis	—	1
Yarrow	—	½

6. Only the autumn-sown was without a crop.

7. Autumn is best, but less convenient, unless subject to severe frost.

8. I have tried it every way. I consider it best to keep off all animals and cut it the first year for hay, unless with autumn-sowing, whereby the plants have more vigour and are deeper rooted. If timothy is trampled when young, the plant, which has a club root, is killed. Top-dressing with chemicals, not with farmyard, the first year is highly beneficial.

9. Yes, in the second year—*i.e.* at the end of the second year.

10. I have not observed this. The clover roots sown in the stewartry of Kirkcudbright (Southwick) disappear the second year, except the natural white clover, which does stand.

11. One year here. Four Southwick.

12. Yes, on moorlands, with very poor results; but the ordinary mixture in this part is—

Ryegrass	1½ to 2 bushels	English red clover	1½ to 2 lbs.
Italian	½ bushel	White Dutch	1½ „ 2 „
Cocksfoot	2 to 4 lbs.	Alsike	1½ „ 2 „
Timothy	2 „ 4 „		

Most of these grasses disappear the second year, and wild grasses come up—often hard fescue and, I think, agrostis stolonifera and other poor grasses; but some fields do throw good feeding grasses.

[*For Schedule of Questions, see page* 126.]

MR. MARK J. STEWART, M.P.—continued.

13. This has not occurred in either of my districts, but farmers are keeping their land down in grass four and five years instead of two and three, and reducing cultivation. Thus there is a reduction of population.

14. If good natural grasses, such as we are now trying to cultivate, grow, we could then keep our land down longer; but in a dairy country the farmer believes—rightly, I think—that young grasses produce milk in greater abundance.

Mr. WILLIAM STRATTON, *Kingston Deverill, Warminster, Wilts.*

1. Various kinds of soil, on chalk subsoil. Some tenacious calcareous clay, and other light black soil, with modifications of these extremes.

2. Drainage was in no case necessary, though the heavy soils are retentive of moisture.

3. Rainfall is heavy, ranging between 30 and 40 inches. Elevation about 600 feet above sea level.

4 and 5. I have tried all sorts of seeds, but prefer a mixture of my own, and do not care to sow expensive seeds. Cocksfoot, 4 lbs.; timothy, 4 lbs.; perennial ryegrass, 12 lbs.; Dutch clover, 4 lbs.; cowgrass, 6 lbs.

6. Sown in a corn crop.

7. Spring-sowing.

8. Mow first year, then feed with cattle or sheep; should dress with farmyard dung when available.

9. Ryegrass does not disappear; but unless manured with nitrogen it becomes weak and small.

10. No; the Dutch clover asserts itself about the month of August.

11. This depends on circumstances; sometimes when conditions are favourable the pasture is good from the first. On heavy calcareous clay land the process is very tedious.

12. I have pastures which were left after sainfoin, nothing else having been sown. Sainfoin has disappeared many years, but a fair pasture now exists. I know some fine grass land which started as a foul wheat-stubble some thirty years ago.

13. Undoubtedly. Labourers have migrated into districts where better wages are paid. It has had the effect of forcing them to better their position.

14. Yes, I approve such a practice in the case of moderately good land.

15. Do not go to any great expense in the matter of your seeds, and make your own mixture. Manure by feeding stock with decorticated cotton-cake.

Mr. WILLIAM DALBY, *Coughton, Redditch.*

1. A heavy loam, with marl subsoil.

2. The land was all Government-drained, 4 feet deep, before the seeds were sown.

3. The climate is humid.

4. In two or three instances a seedsman's mixture of permanent seeds was sown; but generally we have used Webb & Sons' four years' mixtures, which costs about 20*s.* per acre, and, in my opinion, will form as good a pasture and quite as quickly as permanent seeds.

5. The seeds contained perennial grasses, but very little, if any, Italian.

6. Sown with a thin crop of corn.

7. Spring, decidedly.

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MR. WILLIAM DALBY—continued.

8. I prefer pasturing the new grasses with young cattle, and if 2 lbs. or 3 lbs. of decorticated cotton-cake each is given to them daily, it will be found very beneficial to the young grasses, but as a manure on our soil there is nothing to equal bones.

9. I have not noticed the loss of perennial ryegrasses. Italian will disappear in two or three years.

10. I have not noticed the diminution of the clover plant in particular where we have fed off with sheep. Where bones are used as a manure, there will always be sufficient clover.

11. That depends very much upon circumstances; if the land is quite clean, and the seeds are put in early in the spring in a good seed bed, and are treated properly, it should go down to a good pasture in six or seven years.

12. We have one large field, which I understand was allowed to form itself into pasture; it grows very little but coarse indigenous grasses. Four years ago I sowed a few bones on about twenty poles by way of experiment, and the result was marvellous: the next year there was nothing to be seen but Dutch clover.

13. There is not an appreciable reduction in the population in this district.

14. No doubt allowing land to remain in grass for three or four years improves its condition for arable purposes, and I have no doubt, if corn ever is worth growing again, that a great deal of the land that has recently been put down to grass will be broken up.

Mr. C. RANDELL, *Chadbury, near Evesham.*

1. Various, part gravelly loam, part heavy clay upon a retentive subsoil.

2. Yes, all has been drained.

3. Rainfall 27·9 inches. Climate very good.

4 and 5. Twenty years since. 1 bushel cocksfoot, ½ bushel perennial ryegrass, 6 lbs. cowgrass, 2 lbs. Dutch. During the last eight years I have varied the quantities and mixture, finally adopting the following: 10 lbs. cocksfoot, 4 lbs. timothy, 8 lbs. perennial ryegrass, 3 lbs. alsike, 3 lbs. cowgrass, 2 lbs. Dutch. Not using any seedsmen's mixtures.

6. With a crop.

7. Spring.

8. In 1869 I laid down a field of 19 acres for an orchard. It had been fallowed after vetches eaten off by sheep with oil-cake, then sown with wheat, and in the following spring with grass seeds. From that time until this year it has been regularly folded twice or thrice a year by sheep with oil-cake, chaff, and occasionally mangolds also. Only mown twice during the whole period to give the pasture time to sweeten. The effect of this heavy expenditure of purchased food upon the pasture was apparent; it was luxuriant during the first three years, during the second three years the sown grasses gradually disappeared. Nevertheless, for the sake of the fruit trees the same folding was continued, the difference in amount of pasture food being compensated by additional quantities of roots, oil-cake, and chaff. The effect was an increased growth of natural grasses and cocksfoot, and the result now is, a good orchard, with a satisfactory pasture, but not such as would alone repay the cost of the treatment it has received; putting the fruit trees out of the question the field would have paid better in the ordinary course of cropping. During the last seven years I have had several fields of clay-land fallowed and laid down upon untenanted farms. The

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MR. C. RANDELL—continued.

fields were clean, and for the sort of land in good condition. They have been grazed mainly by sheep, on some of the best fields with cake, roots, and corn, on others without trough food; but on all alike, after the first three years the sown grasses have mostly died out, and the land is of very little value.

9. It has disappeared to a great extent with the other sown grasses, but I find that the closer it is grazed the longer it continues. It should never be allowed to go to seed. This, however, is at the expense of the other grasses and clover.

10. Yes.

11. Fifteen years with very liberal treatment; without such treatment, never. I refer only to laying down clay-land in a dry climate; further north, beginning with Staffordshire, I know from experience how much easier it is to convert heavy land to permanent pasture, and how important it is to do so, seeing that dairy-farming pays so much better than corn-growing.

12. When I entered upon this farm in 1839, two fields of about 28 acres had been uncultivated for several years, growing only couch and water-grass, which nothing would eat. Without loss of time I drained, fallowed, burned, and planted with vetches eaten by sheep with oil-cake; the land again fallowed and planted with wheat, then seeds, grazed one year, then wheat again. For 40 years these fields have grown wheat every other year alternately with seeds or vetches, fed off by sheep with oil-cake; artificial manure was applied when thought necessary, but no farmyard manure, the fields being on a steep hill and inaccessible to dung-carts. Now they have been down in seeds two and four years respectively, but water-grass had begun to spread over one, and in the other the grass seeds had disappeared, so I have taken advantage of the dry weather and fallowed both effectively. I know of several fields in this neighbourhood that have gone down to grass during the last ten years. Foul and poor, they are absolutely worthless, and only serve to check the growth of any young stock placed upon them.

13. The additional quantity of land applied to market-gardens and labourers' allotments exceeds the area converted to pasture, so the population is not affected.

14. Yes. I have come to the conclusion, and am acting upon it, that instead of endeavouring to obtain permanent pasture upon clay-land in this climate, there would, at the present prices of wheat and wheat-straw, be a better return for the outlay upon it, if that crop were grown once in five or six years—that is, by leaving it in seeds three, or rather two and a half years. The low price of wheat is in some measure compensated by the high price of straw, which must be sold; the cost of fallowing by steam-power is now very low, artificial manures are cheap, and the seeds are worth more to graze the first two and a half years than they would be for the next ten.

The course would be this:

1st year, Fallow. In a dry year, cultivating twice would suffice, cost 20*s.* per acre; in less favourable seasons it might cost 40*s.*

2nd year, Wheat, with nitrogenous manure; cost not to exceed 35*s.* per acre. Straw to be sold, defraying cost of fallow and manure.

3rd year, Seeds, mown; aftermath grazed by lambs with oil-cake.

4th year, Seeds, grazed.

5th year, Seeds, grazed till midsummer, then fallowed.

In unfavourable seasons for fallowing it might be necessary to take a crop of vetches fed off by sheep with oil-cake between the fallow and the wheat. I must confess to a prejudice against mowing the seeds the first

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MR. C. RANDELL—continued.

year, but I have seen that where this has been done cocksfoot and timothy are stronger afterwards than where the seeds have been grazed. The explanation seems to be this: that the ryegrass is much earlier than cocksfoot the first year, and becomes old sooner. Sheep then prefer the latter, and if the land is stocked with sheep sufficiently to keep down the ryegrass they eat out the heart of the cocksfoot, whereas by mowing the ryegrass, cocksfoot and timothy have time to become stronger, and the pasture after the first year is better than when not mown.

The farms to which I am referring consist in part of useful pasture-land, part good arable land, adapted to the growth of roots and all other crops, which must be kept in tillage to provide winter food for the sheep required in summer upon the clay-land about which I have been writing. In no case would I convert good arable land in this climate to permanent pasture; nor would it be well to leave the seeds down more than one year where the clay-land portion of the farm was to remain in seeds as I propose.

MR. WILLIAM J. HARRIS, *Halwill Manor, Highampton, Devon.*

1. Soil varied, part a light hazel loam on porous subsoil, other parts a stiffer loam on clay (mostly yellow clay). Topsoil from 6 to 12 inches deep.

2. In places draining has been necessary, and wherever permanent seeds have been laid down the wet spots have been cured.

3. The climate is very wet, average rainfall more than forty-five inches.

4. I always select my own seeds. I largely use crested dogstail, cocksfoot, timothy, ribgrass (a little), perennial ryegrass (a good deal), and various clovers, including trefoil.

5. The perennial ryegrass forms at least half of the mixture.

6. I greatly prefer to sow grass seeds with a corn crop.

7. I prefer to sow in the month of April and May.

8. I prefer, if possible, to dress the seeds with very short dung during the first winter, and not to stock at all, or only occasionally with sheep during very dry weather. I cut them the first summer, and then I stock with yearlings or sheep. I sometimes throw a few more permanent seeds, such as crested dogstail and white Dutch clover and trefoil, in the spring of the second year.

9. The ryegrass has always diminished, and that is my reason for sowing a few more permanent seeds in the second year. I, however, consider perennial ryegrass as a valuable grass, and the old meadows have a good deal of it.

10. If stocked too much there would be a diminution, I am sure; but they may be stocked judiciously in dry weather.

11. From four to eight years, and even longer on some land. The land can hardly be called meadow land even in the longer period, but it is useful pasture, that about pays for its cost in manure, &c., as well as a moderate rent. I think artificial manures would make useful grass land if frequently applied, but they do not produce what we in Devonshire call meadows.

12. Yes, I have seen a great deal of this. It seems to be now too generally taking place in some parts of Devonshire.

13. Certainly. In my article in the *National Review*, November 1887, I said:—

"I have mentioned the decrease in population in the parishes around. How is that caused? It is caused entirely by so many farms being without a tenant, and consequently no labour employed. An auctioneer is

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MR. WILLIAM J. HARRIS—continued.

called in every spring, and he sells the feed of every field for the summer months. The amount realised has been in every case for some years past more than the rent that any farmer could possibly pay."

14. This depends on the profit of tilling at present prices. I believe there is a loss on tilling land, and it is better to let it lie in grass, however poor; but I am still breaking land myself, because I wish to keep my men employed.

Mr. R. STRATTON, *The Duffryn, Newport, Monmouthshire.*

1. Sandy loam, in some cases resting on the Old Red Sandstone, in others on gravel.

2. Drainage unnecessary.

3. Rainfall about forty inches; climate generally mild and humid.

4 and 5. My own mixture. I have laid about 120 acres with the following: 1 bushel of common ryegrass, 6 lbs. Dutch, 6 lbs. alsike. I now sow—

Ryegrass . . .	1 peck	Dutch	5 lbs.
Cocksfoot . .	10 lbs.	Alsike . . .	5 „
Timothy . . .	6 „		

6. With corn crop in all cases.

7. I have always sown in spring.

8. I have always mown the first year, subsequently generally grazed, some with sheep entirely, others with sheep and cattle. In one case I have mown every year for twelve years, and generally manured with sheep in winter eating roots and cake. This has done well, always producing a satisfactory crop, and always my first cutting.

9. It has disappeared in great measure, but not entirely; on the field above alluded to there is still a good proportion.

10. There is certainly less than in the first year, but generally there is a fair sprinkling after twelve years.

11. Everything depends on the treatment. Where well manured with farmyard dung, and cake-fed, I have a good pasture the second year; but if starved it will take a long time, and probably be never of much account.

12. I have seen such, and where well treated with manure, and cake-fed, the result has been perfectly satisfactory.

13. That must necessarily be the case. In my own case I have of course reduced my labour bill, but I cannot say that the population has decreased in the neighbourhood in consequence.

14. This depends on circumstances. No doubt the system alluded to will be largely adopted, and is being adopted.

15. I think the great mistake people make is in not treating their newly laid grass liberally. I look upon manure and cake-feeding as the secret of successful laying land down to grass. It depends more on this than on the selection of seed, as the indigenous grasses will assert themselves. But I think the mixture I am now using, above named, is decidedly preferable to the one I used formerly. I have had no experience of the finer grasses here, but from what I have seen I am disposed to stick to my own mixture.

Major F. L. DASHWOOD, *Kirtlington, Oxford.*

My experience in laying land down to grass is not great, but I am in favour of using the best seeds most adapted to the class of soil, to be sown in a thinly drilled crop of corn in the spring—not a barley crop, if possible. To

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be mown the first year, and grazed with cattle the second year, no sheep. To be manured with dung whenever possible. The land not to be allowed to lay itself down, but to be well cleaned, and to be carefully ploughed, so as to leave no hollow places. Should the soil be at all strong, it is most important that it should be carefully ridged up according to the manner most approved of in the district, so as to have the advantage of the surface furrows to shift (so to say) the surface water. This, in my opinion, is most important, even on land well drained.

The general tendency of the replies is to show what a tedious and expensive task it is to make a really good meadow in the corn-growing counties; in fact, in some stiff soils, or in harsh, dry climates, the labour and expenditure may be said to be almost futile in its result. On the other hand, in favourably situated portions of the western country, the pastures form themselves rapidly, especially if assisted by manure and artificial feeding of stock. In almost all cases, it becomes evident that whatever seeds are sown, only those survive that are native to the district, and the blanks where the alien grasses have succumbed are in course of time filled up by indigenous herbage.

The question as to the perennial nature of ryegrass cannot be said to be solved by these inquiries. The opinions are nearly equally divided. Some of my correspondents maintain that it dies out and utterly disappears in two or three years, while others believe either that it is perennial, or that it seeds itself and so continues. There is, however, a nearly unanimous testimony in favour of sowing it in various quantities in permanent grass mixtures, the object being apparently to secure a crop of some kind while the grasses of more tardy growth are developing.

Mr. Martin J. Sutton, from whom I have received most valuable information, writes to me :—

"I would emphasise the following facts:

"(*a.*) That ryegrass is not permanent on all soils.

"(*b.*) That it is, notwithstanding, most valuable for the first few years on the very soils on which it does not become permanent, those soils being just of a character which are most subject to annual weeds, and to burn in drought.

"(*c.*) That ryegrass is the best nurse yet discovered for the finer grasses on these light burning soils, and produces a crop on them the first two or three years, which cannot be obtained in any other way, after which it surrenders its place to fescues, cocksfoot, foxtail, and poas, which have meanwhile become established under its shelter.

"(*d.*) That the true perennial variety is strictly permanent on most soils, and forms the chief constituent of the herbage of the best pastures in the kingdom, many of which have not been mown within the memory of man.

"You will not forget my calling your attention at Newcastle to the fact

that the herbage of the town moor is composed almost entirely of ryegrass, though it is never allowed to grow long enough to mow. It was only because cattle had been shut out of it for some weeks before the Show, that enabled the flower-stems to shoot up, and brought the fact to light."

I was much struck at the time by the evident perennial nature of the ryegrass on the Newcastle Town Moor.

On the other hand, Mr. C. de L. Faunce De Laune, who is a recognised authority on the subject of grasses, is a staunch opponent to ryegrass as a constituent in mixtures for permanent pasture. His experience teaches him that the plants die out, and if they maintain their position in the meadow at all, it is by seeding themselves, after which the stalks become wiry and unpalatable to stock.

Though under certain circumstances it may be expedient to sow the grass seeds in late summer or autumn, the usual practice set forth is spring sowing with a corn crop. Sir John Thorold says that out of four autumnal sowings only one was successful. Mr. Clare Sewell Read recommends sowing in spring in an autumn-sown wheat crop. Mr. James Howard advocates sowing in autumn to avoid competition with annual weeds. Summer droughts are feared for spring-sown seeds, and winter frosts are dangerous for those of the autumnal sowing. In Roxburghshire, Mr. Elliot would leave a long stubble to protect even the spring-sown seeds during their first winter. Nature sows in summer and in autumn, when the herbage is allowed to mature, but then the parent plants afford efficient protection for their offspring.

The treatment of the pasture in its early stage of development is of great importance. The following is a summary of the replies: Take a crop of hay the first year, and feed the aftermath lightly with young cattle getting cake. The second year graze with young cattle, or fold with sheep, both with artificial food. The third year graze again as above, and apply artificials or a light dressing of dung. Manure frequently, and always give supplementary food to the grazing stock.

On the whole, it appears that if the field is to be finally made a good meadow, there is no possible profit in the proceeding until from six to ten years have elapsed. Mr. Charles Randell gives an account of nineteen acres planted for an orchard in 1869, and sown with permanent grass seeds. Ever since it has been folded over twice or thrice a year by sheep, with additional food of cake, chaff, and roots. The pasture is made, but had it not been for the advantage derived by the fruit trees, "the field would have paid better in the ordinary course of cropping."

It apparently takes various periods up to fourteen years to

form a good permanent pasture, much probably depending upon the estimate formed of what a good permanent pasture is. Mr. James Stratton, who has laid 2,000 acres down in Hampshire, says that by following his management the pasture is established in one year; but as he advises subsequent liberal treatment, he can hardly mean that his pasture has been completely made in one year. Mr. W. H. Hall, in the dry climate near Newmarket, has not got a pasture yet, after trials varying from four to fourteen years. Under favourable circumstances, with good land and with liberal treatment, about eight years may be taken as the time that the land requires to eliminate the weeds and unsuitable grasses, and to cover itself with that thick mass of closely growing plants resembling what is seen on sound old natural grazing lands. But, Sir John B. Lawes tells me, there still remains work to be done underground. Thirty years will not produce the dense accumulation of roots found in old grass land, which constitutes a reservoir containing the elements of stored-up fertility in the shape of nitrogen and potash.

Much has been said and written about land being allowed to go to grass without seeds being sown. This appears to have been an ordinary method between two and three hundred years ago. Barnaby Googe, in his "Whole Art and Trade of Husbandry," dated 1614, writes:—

> "When you meane to let your ground lie againe for Meddow or Pasture, your best is to sowe it with Oates, and to harrow the ground even and levell, and to hurle out all the stones, and such things as may hurt the sythe: for Oates is a great breeder of grasse. Some doe cast Hay-seede, gathered from the Hay-loft or the Rackes, over the ground before they harrow it."

Many of our finest old grazing grounds were in all probability started in this simple manner. Sir J. B. Lawes says that no doubt any land, without being sown, will form a pasture in time, but that seeding accelerates the process. Mr. Charles Howard reports that he has heard old farming friends say that some of the best grazing land they knew was what is called "tumble-down." Mr. Curteis Neve gives an account of worthless grasses that he has seen in neighbouring self-sown pastures. Mr. Reginald A. Warren has watched the process in poor brashy land and sour clay in the Cotswold district, and the result has been better than he would have expected. Mr. Clare Sewell Read says such fields cannot make a pasture in a generation, if they ever do. Mr. William Stratton has fair pastures that formed themselves after sainfoin disappeared, and he mentions some fine grass land that started as a foul wheat-stubble thirty years ago.

The speed of the development of a pasture, begun by the easy plan of leaving it alone, depends in a great degree on

climate and soil; the development itself is pretty uniform in its mode of procedure. First the annual weeds have their day, and die out; then the couch-grass spreads, and other inferior grasses luxuriate; finally the good grasses, native to the district, with their delicate and far-reaching roots, appropriate the soil and oust all competitors. Suitable manuring shortens the interval; but, however curtailed, the period of incubation is too long, and land should only be allowed to "tumble down" to grass when it is tenantless, when no money is forthcoming to farm it or to lay it down properly, or, in fact, when nothing else can be done with it.

The agricultural population is slow to move. When the fields that have been ploughed, hoed, and subjected to the other familiar operations of husbandry are transformed to grass land, the labourer silently accepts the diminished demand for his services. If he is a middle-aged man, there is nothing else that he can do. He is too old to learn another trade; he remains in his own village, and gets on as best he can. Farmers usually employ men they know, in preference to strangers wandering about in search of work, so he has a better chance at home. The young men go out into the world, as they always have done more or less, but probably now in increased numbers. The danger is, that the best of them are most likely to go to augment the population of the great towns, and it is not there that the bone and muscle we require are bred.

Individual cases do not make clear whether there are fewer labourers consequent on the conversion of arable to pasture. There must be less money paid for labour, so there must be fewer recipients, or a smaller sum per head earned. The next census returns will throw light on the subject.

Mr. Martin J. Sutton, in his book "Permanent and Temporary Pastures," strongly advocates a two, three, or four years' ley, to meet the depression in corn-growing, especially where permanent pastures are not likely to be successful. He says:—

> "The admirable system, pursued in Lancashire and in Scotland, of annually laying away in artificial grasses a proportion of each farm for a period of three or four years, is so successful that it is surprising the practice has not been adopted all over the country."

It does seem surprising, but there are reasons against the adoption of the system in some parts of the country. Mr. James Howard says the rainfall is not sufficient in his part of Bedfordshire, especially in spring and summer. Sir John Thorold considers the expense of cleaning the land on strong clay would be great. Mr. R. A. Warren fears that when broken up again it must be very foul, and perhaps full of wireworm.

Mr. Clare Sewell Read is strongly in favour of leaving the land down two years; but he would break it up before the third year, to avoid the danger of foul grasses. Mr. Mark J. Stewart, M.P., speaking of a part of Scotland where it is the custom to leave the seeds down for three years, says that the term might be extended if the good natural grasses would grow; but he finds that the dairy-farmers consider that young grasses produce milk in greater abundance. Mr. John Coleman quotes instances of farms in Cheshire where there is no permanent grass, the seeds remaining down five or six years, and, with liberal treatment, producing as much cheese as on the best dairy farms in the county.

Mr. C. Randell boldly attacks the difficult question of the cultivation of clay-land, and gives his course of fallow, wheat, and three years' seeds. He emphasises the necessity of selling the straw, to pay for the cost of the fallowing and the artificial manure for the wheat. The necessity of the fallow on such land shows that couch-grass has to be guarded against. On the chalk, where sainfoin is largely grown, and where the English variety is frequently left down from four to seven years, there remains a legacy, when it is broken up, of couch-grass, water-grass, docks, and other noxious grasses and weeds, that take years to get rid of; wireworm is also commonly found in enormous profusion. This is an example of what occurs when the grasses begin to die out, if left down too long. It will almost certainly occur after two years, when the seed simply consists of clovers and ryegrass.

A judicious selection of seeds that are permanent in their nature should be added to the clover and ryegrass, so that, when they fail, there is something left to take their place; and it is likely that this might be done with sainfoin as well. Mr. James Howard has made some of his pastures by drilling sainfoin and adding permanent grass seeds. The experience of Mr. John Clutton leads him to think that when seeds are supplied to tenants, it might be better to supply a cheaper quantity of seed, and allow the land to be broken up after a short period, as the liberal management subsequently necessary is seldom properly bestowed. There must be a great deal of the permanent grass added annually to the Agricultural Returns that is broken up after three or four years, on its being discovered that there is no likelihood of a good pasture resulting.

The summer of 1887 was so dry that the pastures were scorched quite brown, and it was useless to attempt to discover their condition by personal inspection after the month of June. Earlier in the year I was fortunate enough to be able to see some good examples of recent laying down to grass. Mr. C. de

L. Faunce De Laune, at Sharsted Court, near Sittingbourne in Kent, has lately converted a great portion of his estate into permanent pasture. The appearance of his grass-fields is simply magnificent; they appear to be full of manure, and full of growth. Everything has been done to ensure success. Belts of timber have been planted for shelter, and tall fences of hop-poles packed with hop-bine have been erected for the same purpose—protection from the cold winds off the North Sea being very necessary. Watering-places are found in every enclosure, the water being caught on roads and brought in underground pipes to reservoirs connected with the drinking-ponds. The timber used for gates, hurdles, and hop-poles is all creosoted, and is almost imperishable. The land is very heavily stocked with a breeding flock of Kentish sheep; they have additional food of mangolds, thousand-headed kale, and plenty of cake and corn; the green food is usually consumed on the grass, and, with the cake and corn, manures it very effectively.

The grass is an accomplished fact: it is the most uniform rich green sward that can be imagined, but the cost of obtaining it would have been unjustifiable had grass been the only object in view. Mr. De Laune, however, is happily situated; his soil is good brick-earth above chalk, and he is in the country where cherry orchards abound. A great deal of the artificial feeding of the sheep is for the benefit of the cherry-trees with which nearly every grass-field is planted. There are patriarchal old cherry trees, with far-reaching branches, and there are young cherry trees with only a few twigs on the stem they are grafted on; but all alike are flourishing, and all but the old ones are carefully protected from the sheep by ingenious little cages of creosoted gate-hurdles. With the return that Mr. De Laune is entitled to expect from his cherry trees when in full bearing, almost any expenditure on fertilisers is warranted, and the grass shows the benefit in the meantime.

At Syston Park, near Grantham, in Lincolnshire, I had afforded to me by Sir John Thorold an opportunity of witnessing the progress of a very interesting experiment of pasture and arable farming combined. Certain farms being in hand, Sir John Thorold has been farming them himself, and within the last five or six years he has laid a very considerable extent to grass. There is no inducement here, as at Sharsted Court, to manure heavily for fruit trees; but the farming is of the best, the pastures receiving a treatment very much above the average of land laid down. The soil is very various, ranging from stiff clay to sand. The experiment is still in progress, few of the fields have got beyond the critical age; but even if it is ultimately found necessary to break them up, they will have stored up some fertility in the period of rest, and at present, keeping in view

the number of stock they can carry in the combined pasture and arable system of farming, the result should be profitable.

Mr. James Howard, at Clapham Park, near Bedford, gave me an opportunity of seeing his pastures. The soil is rather stiff clay, difficult to work, and of the class of soil that does not very readily accommodate itself to the operation of grass-sowing. The style of farming is decidedly liberal, manures and feeding-stuffs being by no means spared, and there is a very healthy good-looking covering of herbage all over in consequence. I particularly noticed some fields laid down with sainfoin. The sainfoin is drilled in a corn crop in the ordinary way in springtime, and afterwards the grass seeds are sown; in course of time the sainfoin dies out and the grasses are left to form the pasture, the important thing being that the sainfoin produces valuable hay or forage during the years that the grasses are establishing themselves.

At the Royal Agricultural Society's experimental farm at Woburn, and at Dyson's Wood in Oxfordshire, where Mr. Martin J. Sutton carries on experiments in grass-growing and manuring, I saw much of interest. I also had the advantage of walking over the grass-fields and the experimental grass-plots with Sir John B. Lawes at Rothamsted. The grass-plots, where different artificial manures have been applied for many years—always the same manure to the same plot—are an education in manuring in themselves. Stepping from one plot to another it sometimes seemed like going into another country, the herbage was so totally different, one plot hardly containing a plant of the grass that is the chief constituent of the next; and yet it was all the same old pasture—a portion of the park—when the trials commenced, thirty years ago.

I saw some very successful examples of laying land to grass in the Wealden country south of Reigate. There Mr. John Clutton was kind enough to go over his fields with me, and to show me pastures laid down at almost any time in living memory, with or without a crop, or sown in spring, summer, or autumn. Also one specimen of a pasture made by inoculation, where the turf had been carted on to the land, then chopped up and rolled down, the field differing now not at all in appearance from one sown in the usual way.

This article being of a composite nature, it is open to readers to form their own opinions from what has been put before them. On the whole, I gather from the answers to my questions, and from independent inquiries and observation, that recent experiences in laying land down to grass have not been very encouraging. Were we dealing with low prices that admitted of no change or improvement, it might be wise to convert all the land

to grass that would grow it in any shape; but it may be questioned if we are threatened in such a way. There are signs of improvement even now. Rents have been generally reduced, and farmers have lowered their scale of expenditure on every item to an extent that should render profitable farming possible. One thing seems evident: that farmers do not lay land down to permanent grass, or, if they do, they do it in the cheapest manner. Land-owners do lay down land when they cannot let it, or as an inducement to farmers to become their tenants. But they are unable to ensure treatment that will make a good pasture, so when any change comes that is likely to make arable farming more remunerative, they are sure to yield to the desire of the tenant to break it up.

My statistics, so far as figures can be relied on, tend to show that the conversion of arable to pasture has recently been unprofitable. I come to the conclusion that the great bulk of the land laid down or abandoned during the last ten years may be regarded, though it is termed permanent, as merely temporary pasture. A rise, though it be not a great one, of prices of corn must have the immediate effect of causing all the worst of the new pastures on good land to be broken up, and converted again to tillage, much to the benefit of the country at large.

Tables Nos. I., II., and III. are simply statistical facts that require no explanation. Table No. IV. may be misleading unless it is understood that it is introduced only for purposes of comparison. A unit of value was necessary, so the prices of 1887 were selected, the object being to find out the difference caused by conversion of arable land to pasture, not taking into account the fall in prices. It may be objected that the hay cut from the increased acreage of pasture, and the milk from the greater number of cows, should be put to the credit of the new permanent grass. This has not been done, owing to the difficulty of obtaining accuracy.

I. In Grazing Counties.

—	Acres	Percentage of total acreage	Increase of Permanent Pasture 1887 over 1877	
			acres	per cent.
Total acreage of Permanent Pasture in 1877	7,211,841	56·1	1,015,429	14
Total acreage of Permanent Pasture in 1887	8,257,270	61·7	—	—
In Corn-growing Counties.				
Total acreage of Permanent Pasture in 1877	3,616,175	31·7	673,058	18·6
Total acreage of Permanent Pasture in 1887	4,289,233	37·2	—	—

II. In Grazing Counties.

—	Per cent.	Rotation grasses	Crops
		acres	acres
Percentage of Rotation Grasses to Corn and Green Crops and Bare Fallow in 1877	35·6	1,484,612	4,170,218
Percentage of Rotation Grasses to Corn and Green Crops and Bare Fallow in 1887	40·8	1,484,083	3,634,981
In Corn-growing Counties.			
Percentage of Rotation Grasses to Corn and Green Crops and Bare Fallow in 1877	19·3	1,252,775	6,467,963
Percentage of Rotation Grasses to Corn and Green Crops and Bare Fallow in 1887	22·9	1,341,051	5,848,982

III. In Great Britain.

—	Acres	Percentage of land under all crops, bare fallow, and grass	Increase	
			acres	per cent.
Total acreage of Permanent Pasture in 1872	12,575,606	40·5	1,152,749	1877 over 1872 9·1
Total acreage of Permanent Pasture in 1877	13,728,355	43·2	1,943,040	1887 over 1877 14·1
Total acreage of Permanent Pasture in 1887	15,671,395	48	3,095,789	1887 over 1872 24·6

IV. England.

1877	£		
3,979,650 cattle at £10 .	39,796,500		
18,330,377 sheep at 30/. .	27,495,565		£
2,114,751 pigs at 30/. . .	3,172,126	Total value 1887 . . .	73,826,672
	70,464,191	„ „ 1877 . . .	70,464,191
1887	£		
4,623,715 cattle at £10 .	46,237,150	Increase 1887 over 1877 .	3,362,481
16,452,508 sheep at 30/. .	24,678,762		
1,940,507 pigs at 30/. . .	2,910,760		
	73,826,672		
1877	£		£
acres 7,302,772 corn crops, including straw	56,427,146	Decrease, corn	8,298,023
1887 6,347,008 corn crops, including straw	48,129,123	Increase, cattle, sheep, and pigs	3,362,481
Decrease 1887 from 1877 .	8,298,023		4,935,542

An increase of 1,688,487 acres of permanent pasture in England between 1877 and 1887 thus appears to result in a loss of 4,935,542*l.*

VII.—*Wool and its Uses.* By JOHN W. TURNER, 126 Swan Arcade, Bradford.

IN the eleventh volume of this 'Journal' (1875) there appeared an article by Earl Cathcart entitled "Wool in relation to Science with Practice." It would have been very easy to expand every one of the sections into which that article is divided so as to produce a separate essay; but as yet I have seen no serious attempt to take up and carry on the work so ably and suggestively commenced.

I will take leave to say that after the lapse of thirteen years, during which the "staple" has gone through many changes and vicissitudes, the article is still good reading and contains much valuable food for reflection. As an introduction to my own effort to continue the work let me quote the following paragraph:—

> "I would endeavour for the first time in history to bring the English wool-consumer and the English wool-grower into friendly relations, uniting them on the only sound basis of a mutual understanding of intercommunity of interests promoted by free association and co-operation" (p. 309).

This, I take it, ought to be the keynote of all discussion on this subject. The struggle to retain our supremacy as a manufacturing country grows more keen with every succeeding year, and it is only by earnestly recognising that the interests of the farmer and manufacturer are bound up with each other, that we can hope to maintain our position. The manufacturers of England are doing good work in the way of educating the people connected with various industries, the wool industry in particular. Since Lord Cathcart's paper was written, the manufacturers of Bradford have spent more than 50,000*l.* in founding a Technical College where "science with practice" can be acquired by any townsman, from the manufacturer's son to the son of the labourer. They are moreover committed to a large annual expense, and this without aid from Government—either imperial or municipal. Many other towns are doing the same, so that if we do fall short of our competitors it will not be the fault of the manufacturers of wool.

To quote again from Lord Cathcart's paper:—

> "Mr. Stephens, one of the most practical writers in the whole range of English literature, tells us it would be well for wool-growers to receive lessons from wool-staplers. Wool-growers at present grow their wool in ignorance of the requirements of the home manufacture, and consequently prices and interests are seriously affected."

This paragraph is just as applicable to-day as it was at the time it was written, and if farmers do not get the lessons which their incomplete knowledge requires, it is not in any way the fault of the wool-staplers, who would be only too glad to give instruction and advice to any agriculturists who did not think themselves superior to it, although I am much afraid that with this condition attached the teaching work of the wool-staplers would be light.

Having as a dealer in wool been brought into contact during the greater part of my life with the agricultural community, I may be allowed to say from my own observation that the British farmer knows very little about wool. To him it is a commodity which comes round once a year, and which provides him with a useful sum of money, and there the matter ends. As to what it is made into, and whether there is anything special to be aimed at in its cultivation, he has never been at much pains to ascertain. He has a notion that by some easy process, which is a mine of wealth to the manufacturer, his wool is made into cloth: but of what kinds, and how certain of his proceedings affect the trade, he does not care to know. This was all very well as long as he had the market to himself. But now, with the supplies of wool from all quarters of the globe competing with him as they do, more enlightenment on the matter is necessary if he is to hold his own.

As a contribution towards a better knowledge of the subject, I propose briefly to describe English wool and its uses, before proceeding to discuss its commercial aspects.

Descriptions of English Wool.

English wool may be divided into four principal classes, as follows:—

I. The Leicester or long wool.

II. The Down or short wool.

III. The Half-bred, which is a cross between I. and II.

IV. The Mixed and Broken breeds, *i.e.* containing a cross of Scotch Blackfaced or Mountain breeds.

I. *The Leicester or Long Wool.*—This wool may be subdivided for commercial purposes into Lustre and Demi-lustre. The pure lustre wools[1] are produced only in the counties of

[1] I may be permitted to say here that lustre must not be confounded with colour. Lustre is an intrinsic and inherent silvery brightness of the fibre not lost in process of manufacture, and which cannot be given to goods not made of pure lustre wool.

Lincoln, York, and Nottingham. Lustre wools were formerly made chiefly into ladies' dress goods, known as lustre Orleans, glâces, brilliantines, &c., and were also mixed with mohair and alpaca. Twenty years ago they commanded a much higher price in proportion to other goods than they do now. At that time the fashion had run for a long period on the bright dress goods just mentioned. During the last fifteen years the fashion for these fabrics for ladies' dresses has almost died out, and the principal demand for them has consequently failed. They are now used for coat-linings, dust-cloaks, braids, and purposes where a smooth slippery surface is desired. Lustre or brightness alone, which entered so largely into the enhancement of the value of these wools for dress purposes, is now of secondary importance. It is, however, still necessary that they should be smooth and straight, and any crossing with rougher breeds for the purpose of obtaining weight, or with broken breeds for the sake of the mutton, reduces their value. The crossing of this wool with the Down does not enter into the discussion at this point, as it produces a new breed, of which more in due course.

It must be remembered that in Lustre, as in other wools, the finer the fibre the more valuable is the wool. I have had so much experience of the unconquerable difficulty of making the wool-grower understand this point, that I venture to draw special attention to it. The long-wool grower of Lincolnshire or Gloucestershire, hearing that fine wools are the best to sell, will tell the buyer that he has improved his wool by crossing it with Down and has thus produced finer wool; whereas all he has succeeded in doing has been in many cases to spoil his original breed. He has lost the lustre and smooth straight hair, without obtaining enough of the fineness of the Down to be of any commercial value. A colonist under such circumstances would have preserved the character of his breed, but would have continued it by a careful selection of the finest woolled among his sheep.

My readers will please note that I am not arguing against the crossing of breeds, of which I will say more presently, but merely against the erroneous notion that the fineness of one breed can be grafted into another without altering its original characteristics.

In the demi-lustre wools, the Cotswold may be taken by way of illustration. This wool is made into camlets for men's clothing in China, Japan, and Northern Asia; into lastings for boots and furniture; and into bunting for flags, and some kinds of curtain-stuffs. Its value consists in its length, strength, and solidity of fibre. Whatever fineness of hair can be obtained is

a gain, but this must be done by selection within the family itself, and not by crossing from the outside.

In attempts to improve the breed by crosses of Down and half-bred, the long, straight hair of the Cotswold is broken, and the fine soft hair of the Down is rendered harsh and coarse. It is not too much to say that users of Cotswold wool would prefer it in all its original coarseness, rather than have its character altered by any crossing whatever.

The same remarks apply to the wools of Leicestershire and the Midland Counties generally. Fineness of hair is valuable so long as it is obtained in the right way. These wools are used for classes of dress goods where a certain "handle" is required, and any interference with the breed removes the wool into other channels of trade.

It will perhaps be convenient here to explain the term "handle" as understood by manufacturers. Almost any "handle" can be given to cotton and similar goods by the process of finishing after the goods are woven. But for the kind of wear for which woollen and worsted goods are required this is not possible, as the finish would disappear after being worn a while. Every one knows the difference between the "feel" or "handle" of a piece of flannel and that of a piece of flag-bunting or boot-top lasting, or junior counsel's gown cloth. The one is soft, comparatively uneven and spongy, and the weaving appears indefinite. The other is hard, firm, flat in the surface, with the weave clearly marked. This difference arises from the inherent characteristics of the wool from which the goods are made, which characteristics are "nursed" and made the most of in the process of manufacture. In a word, you cannot make flannel out of Gloucester wool, and you cannot make flags out of Southdown. The "handle" required in the goods must therefore always be present in the wool in the first instance.

II. *The Down or Short Wool.*—In discussing Down wools, quite the opposite set of constituents of value prevail to those which I have referred to above. In this wool, absence of lustre, the finest possible fibre, and not too much length, are the desirable qualities. The principal uses to which Down wools are put are hosiery, under-garments, flannels, and similar goods; also for some woollen goods where a springy light handle is desired. The wool being very curly and elastic, it is specially fitted for all purposes where a somewhat rough and at the same time soft surface is desired. In goods such as worsted coatings and cloth requiring a smooth finish, colonial wool is now always used; but when the fashion runs on cloths with a rough flannel-like surface, being at the same time even and soft to the touch, a good demand for Down wools may be expected. In fact, the value

of Down wools is practically only affected by the changes in fashion in the woollen trade, as the demand for it for hosiery purposes is regular and constant.

Most of the yarns spun from this wool are spun thick, so that length of staple is not desirable, and is, indeed, for some purposes, a positive detriment, as the hairs of short stapled wools in spinning stand out from the yarn, and thus produce a rough flannel-like surface. It will be seen on consideration that the longer the staple is, the flatter the surface of the goods must be, so that if we require flatness of surface, we use colonial wool, which surpasses the finest English as much in this attribute as it does in fineness of hair.

In my opinion there will always be by comparison a good demand for pure-bred Down wools, because they possess qualities which render them suitable for the uses just mentioned in greater perfection than any other wool. But, as already stated, crossing deprives the breed of its best qualities from the wool-buyer's point of view. I have seen Down sheep crossed with all kinds of heavy breeds, and producing wools of all grades of badness. Most of these crosses are made with a view to increase the weight of the fleece or the carcase. Experience shows that the effect of a cross depends greatly upon the district in which the sheep are reared. If a Lincolnshire flock be crossed with Down, the produce is half-bred wool, of good value so far as it goes. But if a Hampshire flock be crossed with Lincolnshire, the effect is bad.

I saw a good illustration of the latter cross some time ago. A clip of wool was sent up from Hampshire to be sold, which many experienced men failed to recognise or name. It was a Down flock, which had been "improved" by crossing with the very heaviest Lincoln. All the good qualities in the two breeds were effectually destroyed. No lustre manufacturer would use the wool, as the lustre had disappeared. No maker of buntings or similar goods could use it, as the staple was too short, whilst for the hosiery trade it was both too long and too coarse. The lot was ultimately sold at about 50 per cent. less than the value of Down, and 25 per cent. less than the value of Lincoln at the time.

The value of purity of breed in Down wools may be seen by comparing the prices of these wools grown in different counties. The value of the best flocks of Sussex Downs this season has been in some cases as high as 14½*d.*; Wilts and Dorsets, also pure bred, a shade less, not being quite so fine; Hampshire, about 13*d.* Eastern Counties, which are bred no one knows how, fetched 11½*d.* to 12½*d.*; while some so-called Downs of that district would probably be dear at 10*d.*

III. *Half-bred Wool.*—This wool occupies, as far as supply

goes, the most important position in the wool-market. It is the largest item in the English clip. It is an ever-increasing quantity in the colonial clip, and probably of the forty million of sheep in America the major portion are half-breds.

Let me here clear away an element of misconception. The term "cross-bred" is used in the London catalogues, when describing colonial wool, to signify the produce of the cross between the Merino and the Leicester. This sometimes puzzles the North-country farmer. In the English wool-trade the word cross-bred means the cross between a good breed and a bad one; as, for instance, between the Leicester and the Scotch Black-faced, in its various degrees. I use the name "half-bred" throughout in the same sense as it is generally used in Yorkshire, to signify a cross between a coarse and a fine-woolled sheep—in English wool the cross between the Leicester (using the name broadly) and the Down, in colonial wool the cross between the Leicester and Merino.

In England, then, the original half-bred is a cross between the Leicester and the Down. But in some districts the half-bred has developed into a distinct breed, which only requires an occasional importation of the original blood to suit the exigencies of different localities. This is notably the case in Norfolk, and the Eastern Counties generally, and also in Shropshire and Staffordshire.

What is required in this class is a moderate length of staple, softness of handle, and the largest amount of the fineness of its Down progenitor that can be obtained. As there is the keenest competition in this class, it follows that the greatest amount of knowledge on the part of the British farmer is necessary to enable him to hold his own in the contest.

A generation ago, some of our half-bred wools were celebrated, and justly so, for their fineness and softness, and they were very much sought after for certain classes of goods. It is a singular coincidence that these wools began to deteriorate in quality and style just at the time that colonial cross-breds were introduced, and for years it appeared as if the growers of half-bred wool in England were playing into the hands of the colonists, whose production steadily increased in quantity and improved in quality, until the home wools were gradually pushed out of certain trades.

There are several districts to which these remarks would apply, but perhaps the case of the Norfolk half-bred wool will illustrate my meaning best. Twenty-five years ago these wools were noted for their fineness and softness, and were bought in large quantities by makers of lastings and similar goods. About this time the growers seem to have become dissatisfied with the weight of their fleeces, and carried away, no doubt, by the high

prices which the neighbouring farmers of Lincolnshire could make of their much heavier wool, they began to take means for increasing the weight of the fleece. The best of these wools probably averaged 6 or 7 lbs. per fleece. After crossing them with Lincoln or Cotswold, they succeeded in getting up the weight to 9 lbs., and sometimes to 11 or 12 lbs.

I have heard many a Norfolk farmer in those days of change boast of the goodness of his wool because it weighed "threes to the tod," or even "twos and threes." The only thing aimed at appeared to be weight, and there was very little thought given to the effect upon the character of the wool. The result has been that the Norfolk half-bred of to-day is a mongrel breed, which is beaten by almost every sort it competes with. There is good wool in the district, but it does not run regularly to the fine sorts as it used to do.

These remarks do not apply alone to the wools of Norfolk and the Eastern Counties. The same mistake has been committed in many other districts, and has been one of the causes of the downward tendency of prices. In 1861 the total import of wool of all kinds into this country was in round figures 150 millions of pounds, or about an equal quantity to our own production. In 1886 our own production had fallen to 136 millions, while the imports had increased to 615 millions.

More than 300 millions of this enormous increase is the produce of Australasia. During the whole of the period the colonial wool has been steadily improving. Everything that attention and business ability can accomplish is done by the colonials to meet the wants of the trade. Thousands of pounds have been spent in England for sheep for breeding purposes, and the greatest skill has been shown in selecting those most suitable. The result is that, with the exception of pure lustre wool, every kind of English wool can be matched and beaten in the London sales. And while all this has been taking place, our own wool in the classes which compete with colonial has been deteriorating.

IV. *Mixed Breeds.*—Under this head I include all wools which have in them a cross of the Scotch Blackfaced, more or less recent, and in various degrees. These wools are to be found in the West and North Ridings of Yorkshire, in Lancashire, Cumberland, Durham, and Northumberland, and throughout Scotland. A great variety of wool is grown in these districts. Some of the very finest half-bred wool is grown in Scotland and Northumberland, known in the trade as North Wool, and possessing soft and silky qualities, which are perhaps unequalled, and almost unique. The Cheviot wool, too, is a special article, which does not seem to be capable of production

away from its native hills. The quantity produced is comparatively small, and Scotch manufacturers generally take care that it does not travel far away from home. Farmers who are able to grow this article will, perhaps, be glad of the hint that it is worth their while to keep it up. There is danger of its disappearance and deterioration from the same causes as have been mentioned in regard to Eastern Counties wool, *i.e.* the attempt to increase the weight at the expense of the quality.

Throughout the North there are various wools which show all kinds of mixtures of Cheviot, North, Blackfaced, and sometimes Down. Some of the branches of this heterogeneous family have become distinct breeds—such, for instance, as Lonks and Mashams—and a large proportion go by the appropriate names of mules and cross-breds.

The value of these broken-bred wools is now somewhat higher in proportion to other wools than it formerly was, owing to various causes. A good many of these wools are utilised in the manufacture of so-called Home-spuns, Cheviots, and Tweeds of the rougher class.

Woollen and Worsted.

A good deal of confusion exists in the minds of people outside the trade as to the meaning of the terms Woollen and Worsted, which it may be as well to clear away. Technically, the difference consists in the structure of the yarn. The aim of the worsted-spinner is to get the fibres to lie parallel to each other, and produce a yarn as fine, smooth, and straight as possible. The object of the woollen-spinner is precisely the reverse, *i.e.* to get the fibres to lie in a certain sense across each other so as to produce a yarn soft, fluffy, or, to coin a word, as flannelly as possible. Different machinery is used in each trade to produce these different effects, but, speaking generally, the difference in the first place is in the wool. All long wools are spun into worsted yarns, and short wools into woollen. Dress goods for ladies' wear are worsted. Cloth for men's wear is generally woollen, with some exceptions, as, for instance, what are known as worsted coatings, which are made of comparatively long wool treated in the worsted fashion. There is, of course, a point of length at which it is difficult to say which trade wool will be used for. French merinos, Henriettas, and the so-called cashmeres, of which a lady's dress is made, are worsted. The soft cloth without pattern, or twill, of which her jacket is made, is generally woollen. Both are made of short wool, the woollen being, of course, the shorter, but both wools a generation ago would have gone into woollen goods.

Improvements in Machinery.

Wools which were formerly considered too short to be combed can now be combed with ease, owing to the improvements in combing-machinery, and are consequently rendered fit for worsted purposes. This has introduced a vast quantity of wool into the dress trade which did not go there formerly, and which has thus become a serious competitor with longer wools. As far as regards improvements in machinery, this utilisation of short wools has been the only factor worth mentioning in the altered condition of the wool market. Wool-working machinery has been brought to great perfection, but it cannot be said that there have been any revolutionary improvements in it, except the one just mentioned, during the last twenty years.

Influence of Imported Wools.

The influence of colonial and foreign wools on the price of English wool is enormous. Twenty-five years ago the total import of wool was only about equal to our own clip. This year we shall probably import five times as much as we grow. Twenty-five years ago the value of the English clip was, roughly, 13,000,000*l.* This year its value is probably 6,000,000*l.* A comparatively small proportion of this serious loss to the farming interest is due to falling off in quantity. The table on the opposite page will show the comparative position of the supply of English and foreign wool.

It is interesting to note, in connection with these figures, that while in 1866 the value of a bale of colonial wool was about 24*l.*, the total value of colonial wool imported was 11,735,000*l.* Whereas, in 1887, with a value per bale of about 14*l.*, the total value was 20,216,000*l.* After allowing for the fact that a larger proportion of the wool is now imported in the grease than was the case twenty years ago, the figures are sufficiently startling. The colonial wool imported in 1887, if taken at the prices of 1866, would show a value of 34,656,000*l.* The price of alpaca in 1866 was 3*s.* 4*d.* per lb.; in 1886 it was about 1*s.* per lb. The value of mohair in 1866 was 3*s.* 8*d.* per lb.; in 1886 it was about 1*s.* 2*d.*

It will be seen from this that the fall in values is not confined to English wool, so that the immense increase of imported wool and the great fall in the value of English do not stand precisely in the relation of cause and effect. There can be no doubt, however, that foreign and colonial wool is a great and increasing factor in determining the value of our own growth. Its influence is felt in every direction.

COMPARISON OF THE QUANTITY OF FOREIGN AND COLONIAL WOOL OF ALL KINDS IMPORTED INTO THIS COUNTRY, AND EXPORTS OF THE SAME, WITH THE PRODUCTION OF ENGLISH WOOL, DURING TWENTY-TWO YEARS, IN ROUND FIGURES.[1]

Year	Imports of foreign and colonial wool	Exports of foreign and colonial wool	Leaving of foreign and colonial wool for home consumption	Home production	Year
	lbs.	lbs.	lbs.	lbs.	
1867	236,000,000	91,000,000	145,000,000	157,000,000	1867
1868	260,000,000	105,000,000	155,000,000	166,000,000	1868
1869	263,000,000	117,000,000	146,000,000	156,000,000	1869
1870	266,000,000	93,000,000	173,000,000	150,000,000	1870
1871	332,000,000	135,000,000	197,000,000	145,000,000	1871
1872	313,000,000	138,000,000	175,000,000	156,000,000	1872
1873	325,000,000	123,000,000	202,000,000	165,000,000	1873
1874	352,000,000	144,000,000	208,000,000	167,000,000	1874
1875	372,000,000	172,000,000	200,000,000	162,000,000	1875
1876	396,000,000	173,000,000	223,000,000	156,000,000	1876
1877	418,000,000	187,000,000	231,000,000	152,000,000	1877
1878	407,000,000	199,000,000	208,000,000	152,000,000	1878
1879	427,000,000	243,000,000	184,000,000	153,000,000	1879
1880	475,000,000	237,000,000	238,000,000	149,000,000	1880
1881	460,000,000	265,000,000	195,000,000	139,000,000	1881
1882	505,000,000	263,000,000	242,000,000	129,000,000	1882
1883	509,000,000	277,000,000	232,000,000	128,000,000	1883
1884	544,000,000	277,000,000	267,000,000	132,000,000	1884
1885	520,000,000	268,000,000	252,000,000	136,000,000	1885
1886	615,000,000	310,000,000	305,000,000	136,000,000	1886
1887	597,000,000	319,000,000	278,000,000	134,000,000	1887
[2] 1888	650,000,000	330,000,000	320,000,000	135,000,000	[2] 1888

It has undoubtedly been considerably helped in consumption by the fashion for soft goods which has now prevailed for some ten or fifteen years. Ladies' dresses nowadays are nearly all made of soft dull material, but it is not generally known that these goods are made entirely of colonial wool. The wearers of these fabrics, which are known by a variety of names, such as Beige, Foulé, Cashmere, Nun's Veiling, Paramatta, Barrathea, Henrietta, Merino, &c., say they are "nicer" than the old-fashioned glâces and cords, which were made from English wool; and so long as this is the feminine idea, English wool must occupy a second or third rate position. As has been said above, pure lustre wool is the only sort with which it does not compete; and as pure lustre is out of fashion, this does not count for much. It will be easily seen that the difference is very great between the quantity of wool required for the dress trade and the quantity required for coat-linings and other subsidiary purposes.

[1] This period is taken because 1867 was the first year when reliable statistics of the growth of English wool were available.

[2] The figures for 1888 are merely estimates of the probable quantities.

Mode of Business.

There are many points about the manner in which colonial wool is sent to market and dealt with, which give it an enormous advantage over our own. The flocks are often very large, and after being shorn, the wool is generally carefully and thoroughly skirted, *i.e.* the short wool growing round the neck and legs and down the belly of the animal is taken off, and packed into separate bales. The wool is also classed into different descriptions—Merino and cross-bred not being mixed in the same bales, except in some of the smaller flocks. The consequence is, that on its arrival in London, large quantities of it can be taken direct to the comber without any sorting whatever. A spinner can go round the warehouses and select the exact sort he wants; and sometimes, during the same evening, he can buy his lots, and have done with this branch of his business for some time.

As the sales generally last from three to six weeks, and as there are seldom less than 10,000 bales offered every night, there is plenty of choice. When this style of business is compared with the dilatory and unbusinesslike manner of buying English wool from the farmer, it will be seen what an immense saving of time and trouble there is to the user of colonial wool as compared with the user of English. A manufacturer can, and often does, purchase as much wool in London in a single night as would take him a month to buy in Lincolnshire or Shropshire. Very few people, except those having actual experience, have any idea of the vast variety of wool which is to be bought in the London sales. Almost every English sort can be matched there, and where the object to be aimed at is fineness of texture and softness of handle, the London Colonial Sale is the market to go to.

It will of course be asked, "What do you suggest as a remedy for the present unbusinesslike manner of dealing in English wool?" An answer to this question brings one on to very delicate ground. It is much easier to point out the defects of the existing system than to suggest a remedy. Probably the first thing to be done would be to stir up the public opinion among wool-growers to some improvement of the system as it exists. It would not be difficult to write an entertaining article on the present manner in which the buyer is treated by the grower. The affection of ignorance as regards prices, the ingenuity with which time is wasted, the endless bargainings, the objection to approach the subject in a businesslike spirit, would be amusing if they were not so expensive and irritating.

In these days of competition, the manufacturer has too many

points to watch to be able to spend the time which his forefathers did in collecting his supply of wool in the days when English manufacturers had a practical monopoly of the world's commerce, and when English wool formed the backbone of the trade. What is wanted is that growers should regard their dealings in wool as a purely commercial transaction, and that the greater the promptitude with which it is got through the better for all parties. The tendency of modern commerce is to bring the producer and consumer nearer together. I suppose that this tendency will reach the English wool-grower some day.

But up to the present the position of things will be best illustrated by the remark that the arrival of one or two consumers in any country district is sufficient to stop any business for a week. They have gone to buy, and presumably the grower wants to sell; but at sight of a wool-buyer from the consuming districts prices are at once put up to a prohibitive level, and it takes about a week of pig-dealing amenities to bring the two parties together and the wool to a market price. The common affection of ignorance of prices on the grower's part will not justify these proceedings. He is not so ignorant as he gives himself out to be when it suits his purpose, and he knows the value of his article just as well as the buyer.

Let the farmer remember the figures of imports of wool which I have given, and dismiss from his mind old-time notions of great rises in price, and of the importance of the position of English wool. Let him meet the buyer in a businesslike spirit. "Time is money" may be truly said of the business now, and the loser is the man who wilfully wastes the time.

Beyond this there is the question of fairs and auctions. Being an auctioneer of wool myself, those who have a profound belief in interested motives as the mainspring of things may, if they choose, take my remarks *cum grano salis.* I certainly incline to the auction as the most businesslike manner of moving the wool from the grower's hands. To be properly successful, however, it requires suiting to the exigencies of the British farmer.

An auction sale of wool should be established on a sufficiently large basis to make it important to the buyer. It should have a public character, and be held under the control of some body which would command the confidence of agriculturists. I throw out the suggestion that the County Agricultural Societies, or, better still, the County Chambers of Agriculture, should take the matter in hand. One of these two bodies should have entire control of the goods, see to the weighing and other details, and appoint the auctioneer. The wool allowed to be sold at these sales should be the *bonâ fide* property of the growers, no dealer or

speculator being allowed to "pitch" wool in them. They should be held at a central point, and where there is a covered market. They should not be held only on one day of the season, but should extend over a series of, say, one day a week for four or five weeks, according to the area of the district. The wool should be sold without reserve, my experience as an auctioneer teaching me that nothing promotes competition so much as the knowledge that the wool is really meant for sale.

Then there is the question of fairs, to which I give the second place. In this case I would apply the same rules, but the dealings would of course be between the user and the grower by private contract, the bargains, however, to be registered by the authority holding the fair. Probably the best illustration of the kind of fair I mean is the one held annually under the auspices of the Leicestershire Agricultural Society. I will, however, point out that the whole of the wool usually shown in this fair might be sold by auction in less than an hour, whereas by the present system of bargaining the actual business generally begins about 4 P.M., the interval between 9 A.M., at which time the fair is supposed to commence, and that hour being spent in vain talk.

Another style of fair is the one which is held weekly at Doncaster during June, July, and August. This is a very large and important fair. There are from 400 to 1,000 sheets a week pitched, chiefly Lincolnshire wool. The railway companies and the corporation of Doncaster provide every facility. But how is the fair regarded by the Lincolnshire farmer? There is probably not 10 per cent. of the total wool shown belonging to the grower. The bulk of the wool sold there is the property of jobbers and dealers who have gone round the county during the preceding week and bought it up.

The wool-stapler, whether in Bradford or in many country districts, fulfils a useful function for which the trade can afford to pay. He understands wool, and classes it to suit the requirements of the manufacturer. Consequently I may remark that, in accordance with sound economic principles, the wool-stapler must always exist. But the man whom I call a jobber knows no more about wool than the farmer. He sells the article in the same condition as he got it. He takes his profit out of it for doing something which the farmers might do for themselves. Doncaster market is under the noses of the Lincolnshire farmers. Many men go there to buy wool who are never seen among the farmers, and who would prefer to deal with the grower for many reasons. They can afford to spend a day at Doncaster, but could not afford to spend a week at the farms over the same or a less quantity of

wool. I will leave this subject to the readers of this Journal with the question: Who pays the Doncaster jobbers' profit?

To the inquiry as to what can be done to enable our farmers to get more for their wool, or even something like old-time prices, I can only reply that, so far as I can see, there is at present very little hope of any substantial rise in prices. Fashion is fickle, and might probably decree some day that we had worn soft stuffs long enough, and that our womankind must clothe themselves in the hard, solid, and good wearing materials made from wools of native growth. But so long as we are content to take our fashions from Paris, this is not likely to take place. Soft goods have always been the peculiar pride of the French manufacturer, and France is consequently deeply interested in keeping up this fashion.

If we were, however, to have a change of fashion in the direction of harder materials, it must not be forgotten that there is a large quantity of wool from the colonies of the cross-bred type, which nearly approaches many English wools in solidity, and that we should not therefore have the trade in our own hands as we formerly had.

An import of more than six hundred millions of pounds of wool is a factor which effectively removes any of the exclusive conditions which formerly helped to keep up the price of English wool. For though it must be admitted that we do not retain quite half of it for the use of our mills, yet we have to compete with the other half in the shape of the manufactured goods of France and Germany in all the markets of the world.

Thus the question is not how English wool can be restored to its old position, for that is impossible, but how it is to hold its own in the competition. I can only say in answer, let the wool which is known to suit a district be grown there in all its ancient purity.

Let the Lincolnshire farmer still grow lustre wool as pure and as fine as he can, as there is a place for his commodity, even if it is only a subsidiary one; and with the continual increase of population this subsidiary purpose will assume greater relative importance.

Let the Southdown grower keep in his mind what his wool is best fitted for, and not make vain attempts to fit it for he knows not what.

Let farmers generally take care that their wool is got up for market better than it often is. It may be thought by some a clever thing to sell a quantity of grease and dirt at the price of wool, but the result must be bad for the community in the competition with the best got-up wool in the world. And in this connection I should like to be allowed to make a quotation from a

paper read by me in 1881 to the Cirencester Chamber of Agriculture, which will also serve to correct a small point in Earl Cathcart's paper on the washing of wool:—

"The wool looks sometimes as if it had been well washed and afterwards riddled over with yellow dust. This, I suppose, arises from the sheep having to be driven a long way to the washing place. There are, I know, great difficulties to get over to remove this fault, but if you would do so you would give to your wool an increased value. It should be borne in mind that wool is never washed with so little injury to the fibre as when it is washed on the sheep's back. The increased severity required to get dirty wool clean in the process of manufacture is injurious, and consequently reduces its value. I saw an article in 'Wool' the other day in which the use of hot water and soap was advocated. With this idea I entirely disagree. I venture to say that the use of hot water or soap is positively injurious to English wool. What I would recommend (of course with all reservations as to convenience) is tub-washing in cold water.

"The following manner has, I believe, proved successful:—Having two tanks, each capable of holding, say, five sheep, let the sheep be placed in tank number one and washed in the usual manner; then let them be plunged in the second tank, which must be kept constantly supplied with clear water—or, better still, let them have a swim in running water. It should be remembered that the first tank should be kept as greasy as possible from the yolk which exudes from the sheep, only as much water being added as the sheep take out with them. This yolk is a kind of natural soap, and is quite sufficient to wash the sheep properly if proper advantage is taken of it."

I would only add to this that all recent science shows alkali to be injurious to wool, and where it is necessary to be used in order to get rid of "dirt" it can only be used safely by experts who know how to minimise its effects. Manufacturers prefer buying wool which has not been washed at all to wool which has been scoured with soap, especially where it has to be dyed into delicate colours.

There are many faults in English clips arising from carelessness, such as the presence of straw and chaff in the wool, which may appear trifles to the farmers. But these faults all cost money to rectify; and when home wools have to compete with the wool of the colonies, which requires no such expense, these trifles grow into importance.

Let English wool-growers keep in their minds the fact that there is a growing export trade in their wools which amounts now to about 23,000,000 lbs. annually, and which may be increased if these apparently trifling points are properly attended to. More than half of this export trade is to America, where it has 5*d.* per lb. duty to pay, and where labour is expensive. Ten cents a pound is a heavy duty to pay on dirt and grease, and American buyers are not likely to come away from home for wool which requires labour to fit it for use. It may be as well to note here that one of the favourite wools with export buyers is Irish, which is the best washed and the best got-up of any in the United Kingdom, and is preferred for these reasons.

A healthy public opinion among agriculturists, and a feeling that both the grower and the manufacturer have the same interests to serve, will set many matters right. We in the manufacturing districts are as strongly of opinion as the agriculturists are that things are too cheap; but both can, at all events, resolve that what they produce shall be good.

VIII.—*Recent Improvements in Cider and Perry Making.*

By D. R. Chapman, The Athenæum, Liverpool.

In these days of keen competition and agricultural depression it becomes a duty to look more closely into comparatively small matters, and either endeavour to find new fields of energy, or point out old sources of income which have been neglected, but which may be revived with some prospect of success. Among the latter is one which until a century since was a source of great profit to many, but now has fallen into great neglect—viz. the production of those pleasant and wholesome drinks, when pure, Cider and Perry.

Both liquors have a pleasant sub-acid taste, and are very clean on the palate, perry as a general rule being much the sweeter of the two. Among our forefathers they were supposed to conduce to longevity and possess many medicinal qualities, and this opinion still remains in the cider-growing districts. Many eulogiums have been written in their praise, notably "Phillip's Cyder," and two quaint old tracts, one of which was written by the Vicar of Dilwyn in 1677, and is quoted in Dingley's "History from Marble," who says:—

> "Our flourishing orchards . . . yield us plenty of rich and winy liquors, w^{h} long experience hath taught do conduce very much to the constant health and long lives of our inhabitants, the Cottagers as well as y^{e} wealthier using for the most part little other liquors in their families, than restorative syder;"

and in a poem of some length again says:—

> "With all the Gallick wines are not so boone
> As Hearty Sider, y^{e} strong son of wood
> In fullest tydes refines and purges blood."

At the end he gives a list of six or eight persons who died in his own parish during his vicarage, whose drink was nothing but cider, and whose ages ranged from ninety to one hundred and fourteen. The other tract relates a morrice dance which occurred at Morehampton, where ten persons danced whose united ages reached the total of more than a thousand years. Perry made from the Barland pear is supposed to be good for

diseases of the bladder and kidneys, and is taken and recommended for them in the districts where that fruit is cultivated.

The cider-producing districts in England at the present time may be divided into two: one, which may be called the West Midland district, embracing Herefordshire, Worcestershire, and parts of Gloucestershire and Monmouthshire; the other, the Western district, containing the three counties of Somerset, Devon, and Cornwall. Cider was formerly made in some quantities in Kent and Sussex, but, for reasons which will be stated when treating of those counties, the manufacture has ceased, at any rate for the market. At what time the apple was introduced into the West Midland district is not very clear, but that there were good and bad kinds in the fourteenth century we can gather from the old poem "Piers Plowman's Visions," where the following lines occur:—

> "I preide Piers tho to pulle a down
> An appul and he wolde,
> And suffer me to assaien
> What savour it hadde"—

while in the sixteenth century we have the testimony of old Gerarde—who says in his "Herbal," A.D. 1597:—

> "But I haue seene in the pastures and hedgerows about the grounds of a worshipful Gentleman dwelling two miles frow Hereford, called Master *Roger Bodnome*, so many trees of all sorts, that the seruants drinke for the most part no other drinke but that which is made of apples; the quantity is such, that by the report of the worthy Gentleman himself the Parson hath for tithes many hogsheads of Syder"—

that both the apple and the cider made from it were common and well known. Some sixty or seventy years after, the cultivation of this tree received a great impetus from the care and attention bestowed upon it by Lord Scudamore of Holm Lacy, who, while serving his country as Ambassador to the Court of France, obtained grafts and cuttings of the best fruits grown in that country and distributed them through the orchards of his native county. But, although the impetus received in the cultivation of the tree was great, the manufacture of cider did not reach its zenith until quite a century later.

Worcestershire has always been more celebrated for its perry. In Gloucestershire and Monmouthshire, until a very late period, the orchards were chiefly confined to the Herefordshire sides of both counties, but the cultivation of both the apple and pear has spread considerably of late years, although perhaps more in the case of Gloucestershire with reference to the cultivation of what are known as "soft fruits," than those more especially devoted to the manufacture of cider and perry. This county, like Worcester, is better known as a perry-producing district. With few exceptions, the orchards throughout the whole of this district

had been allowed to fall into a state of great neglect; but chiefly owing to the exertions of the Woolhope Naturalists' Field Club, who meet at Hereford, and under whose auspices that magnificent work "The Herefordshire Pomona" was published some two or three years since, a great deal of attention has been paid to them which it is hoped in a few years' time will amply repay the owners.

The following table will show at a glance the number of acres under orchard cultivation since about 1810; but it is not to be supposed that these plantations are all devoted to the cultivation of cider and perry fruits, as great quantities of soft fruits are now grown:—

Date	Hereford	Worcester	Gloucester	Monmouth
1810	—	—	6,000	—
1871	20,811	11,057	10,841	2,672
1881	27,000	16,000	14,170	3,800
1886	27,112	18,527	15,500	4,027

In the Western district the writer has been unable to trace the first mention of cider or perry; but from time immemorial both Devon and Somerset have been famed for their orchards, and in recent years an extensive trade has been carried on in both these beverages. Comparatively little cider is made in Cornwall, but the Devon and Somerset sides of Dorset produce excellent cider, and a good deal of attention has been paid of late years to the orchards of that section of the West country. Although some perry is made in this district, no corrections or additions have been made to the list of pears appended to this paper, from which it would appear that either the kinds mentioned are the ones grown in the West Midland District, or the writer has not been fortunate enough to come upon any one who can give him any information upon this point. Singularly enough, although large collections of cider fruit were sent to the different Pomona shows held at Hereford under the auspices of the Woolhope Club, no perry fruit was ever sent.

The following table will show the acreage under orchards in this district:—

Date	Devon	Somerset	Cornwall
1871	30,013	16,267	7,408
1881	26,000	22,800	4,800
1886	26,414	23,640	5,120

As in Kent and Sussex comparatively little cider is now made, it has not been thought necessary to give the acreage of orchards under cultivation. In the former county the Kentish Goff used

to be planted and grown for the purpose, but latterly it has been found more profitable to make it into jam. What little cider or perry is now made in either of these two counties is manufactured for home consumption from the fallings of the trees, cultivated as soft fruits.

In Norfolk some cider of a good quality is still made, but from what fruits the writer has been unable to determine.

The causes which led to the deterioration of the orchards, and through this to the bad quality of the liquors produced therefrom, were many, and varied to some extent with the position of the different districts. The first and primary cause was doubtless our continual wars from about 1740 to 1820. During the whole of that period we may be said to have been constantly embroiled either with one of our Continental neighbours or with America. At that time our population was comparatively very small, and the constant warfare at sea made it a primary necessity that greater care should be taken by the agricultural community in the production of food, both cereal and cattle, for their countrymen. From the very fact of the demand being great and the supply limited, high prices arose. Farmers grew rich, they took larger farms in order to cultivate that which paid them best, and this led to the neglect of the orchard: so that, instead of cider or perry being made of a good quality for the market, the fruits were in most cases mixed indiscriminately, and only a small portion really good made for the use of the homestead.

Unfortunately this was not the only result of the neglect. The trees themselves were left unpruned and uncared for, unless faggots were wanted for burning, until they died; when, instead of replacing the old sorts by young trees of the same kind or better, a good-looking seedling or wilding was put in. Worse still, this kind of proceeding was contagious, and, if one may say so, in some degree hereditary. The son thought what was good enough for his father was good enough for him; or perhaps a new local variety bearing a great reputation had meanwhile sprung up, which was duly planted, and so made confusion worse confounded. This has gone on down to the present day, with such deplorable results that it has been stated upon good authority that fully one half of the trees in our orchards should either be cut down and regrafted with well-known kinds, or uprooted altogether.

Again, the liquors were taxed, and the constant presence of the Inland Revenue officer, during the different stages of manufacture, was a source of annoyance and disgust to the farmer, who, rather than be bothered with his presence, gave up making altogether. True, the tax was ultimately repealed, but too late; the mischief it had wrought had been completed. Although a

considerable quantity of cider was still made, it was of an inferior quality, and all that remained over from the quantity required for home consumption passed into the hands of the middleman, when the culminating point of the mischief already wrought was completed. In his hands all kinds were indiscriminately mixed together, and, in too many cases, such filthy and nauseous ingredients were used in fermenting and fining it, that when the liquor was sent out it was at times very difficult to say what it was. This compound was bottled, and placed upon the markets at London and Bristol—then the principal places to which this kind of produce was sent—and from them distributed over the country. Some of it is said to have travelled as far as Hamburg, and then made its re-appearance here as fine old port and sherry. Even now, at the present day, a good deal finds its way into the hands of wine-merchants; but what they do with it is best known to themselves, as it never reappears under the name by which it was sold to them.

In England the cultivation of pears for the manufacture of perry is carried on in the counties of Worcester and Gloucester and that portion of Herefordshire adjoining them, and in the counties of Devon and Somerset. In France and the Channel Islands, the cultivation of the pear for the purpose of perry-making may be said to be entirely neglected. It is somewhat difficult to account for this, unless it be from the greater autumn temperature, which would render the higher fermentation of the liquor much more difficult to carry through than in England. For what little they make in those countries the worst of the dessert fruit is used, which is not always a success, as it is as true of pears as of apples, "the smaller the fruit, the better the liquor"; and again, ripe and unripe fruits are ground up together. In Germany, the pear, on the contrary, is extensively cultivated, not so much for its value as a drink, but for distilling into brandy, which is said to be of excellent quality. In America they are only just commencing to cultivate the pear for perry-making; what they have hitherto manufactured has been from dessert pears which could not be readily disposed of.

Before proceeding to the consideration of the subject, it may perhaps be as well to consider a little the qualities which good cider and perry fruit should possess. The subject will be fully considered when the manufacture of the liquor is treated of, but it will do no harm to lay before the grower the various qualities he should keep in view. These are three:

1. It should be a free bearer.
2. The fruit should possess all those qualities which are necessary for the production of a good cider or perry.

3. The tree should be hardy, of vigorous and rather upright growth, as those with a drooping habit are very liable to have the lower branches broken off by the cattle which would graze the orchard after it was firmly established.

Unfortunately, as a general rule, the best fruits are apt to be rather shy bearers, or produce a crop every other year, while many of the second-class varieties are very free bearers and growers. This being the case, it would always be judicious to plant some of the latter, as they would furnish a certain quantity of liquor, which could be strengthened and improved by the admixture of that derived from the former—the best fruits, in short, supplying what the second-rate ones lack. When the best fruits, however, do bear well, they make ample amends for their capriciousness by the enhanced value of their cider or perry.

In order to lay before the reader at a glance the best fruits for his purpose, a table has been prepared showing the name of the fruit; growth and habit of the trees; time of blossoming and ripening its fruit; the density of the juice after twenty-four hours' exposure to the air; the percentage of sugar contained in each 100 parts; the percentage of tannin, mucilage, and salts in the same quantity; the principal locality in which the particular fruit is commonly grown; and other remarks which may add to the value of the description (see next and following pages).

For assistance in compiling this table the writer has to tender his warmest thanks to a number of gentlemen, most of them strangers to him, who have so kindly supplied him with lists of the best fruits grown in their respective districts, and notably to Messrs. J. H. Arkwright, of Hampton Court, Leominster; John Watkins, Pomona Farm, Withington; Lt.-Col. Halifax Wyatt, Croxteth Park, Liverpool; Messrs. R. Welch, Stocklinch, Ilminster; Le Cornu, Jersey; and H. C. Mewburn, of Stamford, Co. Welland, Ontario.

Of the above, those marked with an asterisk are considered the best grown in England for cider and perry making; but an eminent cider and perry manufacturer in the West Midland District, Mr. John Watkins of Withington, writes as follows:—

"If I were going to plant an orchard for cider and profit only, I should plant broad-leaved Norman to get the crop, Kingston Black and Cherry Pearmain the flavour, and Cherry Norman, White Bache, and Handsome Norman the saccharine matter; the three first I consider the most profitable."

Many other kinds would be as profitable in the writer's estimation, but probably the crops would not be so sure, notably the Foxwhelp, Skyrme's Kernel, and the Royal Wilding, as

APPLES.

Name of variety	County where grown	Growth and habit	Time of blossoming and ripening fruit	Density of juice	Sugar	Tannin, mucilage, salts, &c.	Remarks
Alford . . .	Devon	Large, spreading; free bearer	—	—	—	—	—
Ancell . . .	Gloucester	Large, erect; free bearer	—	—	—	—	—
Belle Orchard Seedling *Ledbury Belle*	Hereford	Medium, upright, vigorous; free bearer	—	—	—	—	—
Black Norman .	Hereford	Hardy; free bearer	End of May	1·037	11·9	1·125	Makes a good cider
" *Hereford* .	—	Moderate grower	End of October	—	—	—	—
*Broad-leaved Norman —— —— *Hereford*	Hereford	Hardy; free grower and bearer	End of May End of October	—	—	—	—
*Cherry Norman .	Hereford	Hardy; free grower	—	1·045	12·8	2·07	—
—— *Hereford* .	—	Moderate bearer					
*—— Pearmain .	—	Hardy; medium grower, good bearer	—	1·05	12·7	2·0	One of the most useful apples a farmer can grow
Chibbles Wilding .	Somerset	—	—	—	—	—	—
Cider Brandy Apple	Worcester	—	—	—	—	—	—
—— Lady's Fingers	Hereford	Hardy; free bearer	Second week in May End of September	1·045	13·25	1·4	—
Coccagee . .	Hereford Somerset Devon	Hardy; moderate grower, free bearer	Middle of May	1·056	9·08	7·8	Going out of use in Somersetshire
*Cowarne, Red .	Hereford	Medium grower and bearer	—	1·047	11·9	1·42	—
*Cummy Norman . *Cummy*	Hereford	Hardy; free grower and bearer	—	1·04	14·0	0·06	A very small fruit
Deane's Bittersweet	Devon Somerset	Large, handsome; good bearer	—	—	—	—	—
Dymock Red .	Gloucester Hereford	Hardy; free grower and bearer	—	1·037	12·1	3·5	—
*Eggleton Styre .	Hereford	Hardy; good grower; free bearer	Middle of May Middle of October	1·05	10·6	6·57	—
*Foxwhelp (Old) .	Hereford	Rather large; slow grower, shy bearer	Middle of May End of October	1·07	14·4	8·5	What few trees there were in the Western District are now going out of cultivation
Foxwhelp (New or Rejuvenated)	Hereford	Fair grower, medium bearer	—	1·044	8·0	4·3	A good sauce-apple, sells well as pot fruit
Green Wilding .	Hereford	Hardy, upright; free grower and good bearer	—	1·045	10·53	3·17	—
Golden Moyle .	Hereford	Large; free grower and bearer	—	—	—	—	Sells well for jam-making

APPLES—*continued.*

Name of variety	County where grown	Growth and habit	Time of blossoming and ripening fruit	Density of juice	Sugar	Tannin, mucilage, salts, &c.	Remarks
*Hangdown *Horner*	Somerset	Small, spreading; very free bearer	—	—	—	—	—
*Handsome Norman —— *Hereford* *Belle Norman* *La Belle Normandie*	Hereford	Moderate grower; rather small, good bearer	Middle of May End of October	1·052	11·9	4·04	—
*Hollow Core .	Somerset	Free grower and bearer	—	—	—	—	Sells well as pot fruit
Jersey Chisel . *Chisel Jersey* *Bitter Jersey*	Somerset	Free grower, good bearer	—	—	—	—	—
Joeby Crabb .	Hereford	Free grower, fair cropper	—	1·052	10·3	4·4	Makes a very strong rough cider
*Kingston Black . *Black Kingston* *Taynton Black* *Taunton Black* *Dormington Red*	Somerset Hereford	Medium size, spreading; first-rate cropper	—	1·053	10·03	6·8	This first-rate fruit has, strange to say, gone very much out of cultivation in its native district, the Western
Morgan's Sweet .	Somerset	Hardy, vigorous grower; good bearer	Early	—	—	—	—
Ponsford . .	Devon Somerset	Hardy; free grower and bearer	—	—	—	—	Sells well as pot fruit
*Red Norman . . —— *Hereford*	Hereford	Small; fair bearer	Middle of May End of October	1·049	11·9	4·0	—
*Royal Wilding . *The Cadbury*	Hereford	Hardy, spreading; shy bearer	End of May	1·037	10·7	4·7	Cider turns dark in the cup
*Skyrme's Kernel .	Hereford	Fairly hardy; free grower, shy bearer	—	1·035	10·6	3·6	—
*Slack-my-Girdle .	Devon Somerset	Hardy; free grower and bearer	—	—	—	—	Sells well as pot fruit
Strawberry Norman *Hereford*	Hereford	Hardy; free grower, spreading, good bearer	Middle of May End of October	1·045	13·74	1·07	Cider turns dark in the cup
Red Cluster . .	Devon Somerset	Large, free grower	—	—	—	—	The trees are apt to split
Red Cap . . *Cap of Liberty*	Devon Somerset	Fair grower, good bearer	—	—	—	—	Good fruit for mixing
Red Splash . . *Rollings Kernel*	Hereford Worcester	Hardy; good grower, free bearer	—	1·042	9·6	4·8	Poor cider, but the fruit commands a ready sale for jam-making
*Stone Apple . .	Devon Somerset	Free grower, good bearer	—	—	—	—	Fruit large and handsome
*Styre Wilding . *Canon Bittersweet .*	Hereford	Hardy small; bears profusely every second year	Middle of May Beginning of November	1·044	14·12	0·68	—

APPLES—*continued.*

Name of variety	County where grown	Growth and habit	Time of blossoming and ripening fruit	Density of juice	Sugar	Tannin, mucilage, salts, &c.	Remarks
Taunton Fair Maid	Somerset	Free grower, good bearer	—	—	—	—	Sells well as pot fruit
*White Bache „ *Norman* „ *Hereford*	Hereford	Hardy, rather small, vigorous; very heavy cropper	Beginning of May End of October	1·041	10·78	3·63	—
* „ Jersey	Somerset	Free grower, good bearer	Late	—	—	—	—
Yellow Styre	Hereford Worcester	Hardy; free grower, good bearer	—	—	—	—	—

PEARS.

Name of variety	County where grown	Growth and habit	Time of blossoming and ripening fruit	Density of juice	Sugar	Tannin, mucilage, salts, &c.	Remarks
*Barland *Bosbury Pear* *Bareland Pear* *Bearland Pear*	Hereford Gloucester Worcester	Very large, vigorous; free bearer	—	1·043	10·67	2·77	—
*Black Huffcap	Hereford	Hardy; free bearer	Beginning of May	1·050	11·22	3·58	—
Butt Pear	Gloucester Hereford Worcester	Hardy, free grower; good bearer	—	1·043	10·7	3·3	—
*Holmer Pear	Hereford	Hardy, large, vigorous; good bearer	Beginning of May	1·055	11·9	3·4	—
*Longland *Longdon Pear*	Hereford	Very hardy, good grower, and heavy cropper	—	1·040	8·4	4·19	—
Moorcroft *Malvern Pear* *Malvern Hill Pear*	Hereford Worcester	Large spreading, hardy; good bearer	Beginning of May	1 049	11·9	2·39	—
Newbridge Pear	Worcester	Large, hardy; good bearer	—	1·049	10·03	2·67	—
New Meadow	Worcester Hereford	Upright, hardy; free bearer	—	1·048	12·0	3·3	—
*Oldfield	Hereford	Large, hardy; free bearer	Middle of May	1·061	13·06	3·7	—
Pine Pear	—	Hardy; free grower and bearer	—	1·040	9·3	4·1	—
Red Pear *Red Horse Pear*	—	Hardy; heavy cropper	Beginning of May Beginning of October	1·039	8·74	3·2	—
*Rock Pear	Worcester	Hardy, upright growth; bears well every second year	—	1·084	17·6	4·15	—
*Taynton Squash	Gloucester	Hardy, large; free bearer	End of April Middle of September	1·057	13·47	3·03	—
Thorn Pear	Worcester Hereford	Small, hardy; very heavy cropper	—	1·047	11·5	1·4	—
*Yellow Huffcap	Hereford	Hardy; fair cropper	Beginning of May	1·049	11·24	2·3	—

the enhanced price obtained for the produce in a good year would about counterbalance the losses from a bad season. If, however, to Mr. Watkins's list be added the Eggleton Styre and Strawberry Norman, the planter in the West Midland District cannot possibly go wrong.

In the Western the favourite fruits and the ones best for cider-making are the Coccagee; the Kingston Black, which ought to be kept up, as it is certainly one of the best cider apples grown; the Horner, or Hangdown, the Hollow Core, the Jersey Chisel, and the Red Cap. Besides these many of the culinary and dessert apples make good cider. That famous old apple, so well known all over England, "Tom Putt," makes really good cider for home consumption and drinking off from draught, as do the Norfolk and Hereford Beefings, with the russets and many others. In America it is the rule to make all the cider and perry from the culinary and dessert fruit, using such as the following among apples: Duchess of Oldenburgh, Northern Spy, Baldwin, Golden Russet, &c.; while the pears are all the best kinds which cannot be got rid of before they spoil—cider and perry fruit, as we know it, appearing comparatively unknown. In Jersey it is much the same with the little which is now made there.

The time of year at which the fruit ripens is an important consideration. Many of the early varieties are, as before stated, free bearers, and make excellent cider, but there is great difficulty in carrying the liquor through the various processes of fermentation because of the warm weather of the autumn. This subject will, however, be more fully treated when the manufacture of cider and perry is considered.

Gathering the Fruit.—This should, as far as possible, be done under the grower's personal supervision. The proper time will soon be seen by the change of colour and strong odour given out by the fruit when ripe, as also by its dropping from the tree. On no pretext whatever should a beating pole, for the purpose of knocking the fruits off the branches, be allowed, as the next year's crop would be greatly damaged by the fruit buds being beaten off at the same time. The fruits should be hand-picked as far as possible, the labourer mounting the tree and shaking off the fruit he cannot reach by means of a pole having a crook at the end. The fruit should be protected from damage by falling, where the grass in the orchard is not long enough, by some straw strewn under the trees. During this operation the advantage of having one variety of fruit together, instead of being planted indiscriminately over the orchard, will be very apparent.

As the fruit is picked, it should be taken and placed in a

heap, each variety by itself, and protected by some means from the rain until it is fit for the mill. If not so protected, the fruit will both lose a quantity of saccharine matter, and its period of maturity be considerably retarded by the alternations of heat and damp to which it is subjected. The heaps should not be too deep—say about a foot or fifteen inches—or the fruit will heat and ferment. If the grower should have barns or other places at his disposal in which he can store his fruits, so much the better; but, failing these, a cheap and easily made shelter sufficient for the purpose would be mats made out of long straw fastened between two poles or lathes either with tarred twine or iron wire. In France, as a general rule, granaries and barns are much used, with great advantage to the cider made, it appearing from experiments made upon two samples of liquor—the one made from apples exposed in the orchard, and the other from apples matured in a granary—that the latter contained, six months after being made, one and a half per cent. more alcohol than the former. In America the freezing-houses which are on every fruit farm are used for the same purpose. For a description and details of these buildings the reader is referred to "Downing's American Orchardist." Those fruits which have been blown off the trees or dropped off should not be mixed with those gathered, but be put through the mill by themselves, when they will make a liquor for immediate consumption.

All cider fruits may be divided into three classes, viz. the sweet, the bitter-sweet, and the acid; all of which communicate a distinct taste and property to the cider made from them. The sweet fruit produces a pleasant, agreeable drink, which must be consumed at once, or it will soon become bitter and ropy; the bitter-sweet, on the contrary, makes an excellent cider, of good, long-keeping qualities, which may be accounted for by the presence of the bitter principle; while the acid fruits give a liquor fit for no other purpose than making vinegar.

Good cider owes its flavour and long-keeping qualities mainly to the presence of two substances, viz. sugar and tannin: the sugar forming alcohol under the action of fermentation, and the tannin assisting to keep the liquor clear and bright afterwards; but their parts will be more fully treated when that action is discussed.

In order to determine the value of the juice, it is necessary to employ a saccharometer, which is used in the following manner:—

Five or six apples are taken of the kind it is desired to test, and the juice crushed out and filtered. The instrument being placed in the juice

will float and ultimately settle down at a mark on a scale graduated on the instrument, which scale starts from 1000, that being taken to be the density of distilled water at 39° Fahrenheit.

Appended is a table, showing the amount of sugar contained in a quart of fresh apple-juice, and the percentage of absolute alcohol it will produce on fermentation. The table commences at density 1·035, which is the very lowest that should be used; indeed, no *good* cider can be made under 1·040, as there is not sufficient sugar under this density to impart good keeping qualities. For this reason, fairly good cider should contain about six per cent. of alcohol, and about one-fifth of its density should be left of unreduced sugar to give it sweetness and body. The so-called champagne cider has its characteristic effervescence entirely due to this. It should be natural, but is helped by the insertion of a little powdered lump-sugar in each bottle before the cider is racked into them. It will thus be seen that the saccharometer will indicate those fruits which it may either be desirable to keep or eradicate from the orchard.

Density of juice	Sugar in 40 ozs.	Percentage of alcohol
1·035	2·479	4·12
1·040	2·688	4·85
1·045	3·559	5·65
1·050	3·808	6·43
1·055	4·688	7·26
1·060	4·923	8·11
1·065	5·802	8·76
1·070	6·027	9·50
1·075	6·915	10·51
1·080	7·155	11·33

The fruit, having been fully ripened, should be used at once, as then the normal quantity of sugar present in each kind is fully developed. Should the fruit be allowed to become over-ripe, and rottenness have set in, a portion of the sugar is lost by the fermentation which then takes place. The proper time is generally determined by the agreeable odour which is given out by the heaps, but it may also be seen in the change of colour of the skin, the dark tint of the pips, and small veining or spots which begin to run over the skin. It is most essential that the fruit should be used as soon as it has ripened, and on no account should any rotten fruit be allowed to get into the mill.

In all the operations now about to be described, too much stress cannot be laid upon the necessity of cleanliness. Unless everything about the cider-house is perfectly sweet and clean, all the harvest of the year will either be considerably deteriorated or utterly ruined. Especially should great attention be paid to all implements having iron or lead about them. It is

for this reason that many cider-makers still adhere to the old stone mill, and with good reason. The acid in the fruit must act upon the iron in some degree. It may be slight, and doubtless is in most cases, but there is always the danger of the presence of rust, which, held in solution by the cider, will turn it black upon exposure to the air. By far the greater danger, however, arises from the contact of the cider with lead, as the liquor easily dissolves that metal and holds it in solution, with very dangerous consequences to the consumer. Too much care, therefore, can never be taken to prevent their contact. It is impossible altogether to prevent it, because the trough stones are held together by iron clamps leaded in; but they can easily be cleaned before use and kept clean afterwards. The pulp should not be allowed to remain in the trough for any length of time, and under no circumstances whatever should a leaky cask be stopped with white or red lead.

For the purpose of grinding the fruit and reducing it to a pulp—which is known indifferently as the "math," "cheese," or "cake"—many machines have been invented, the principal of which are here described. The old machine was a circular trough of wood, having a heavy wooden roller studded with large nails revolving in it, which crushed the fruit; but the necessity for a greater weight to crush it more led to the employment of stone troughs and rollers. It consists of the following parts: the trough, the bruising-stone or roller, cog-wheel, and upright axle.

The *trough,* which of course is circular, is of stone, and hollowed out to the depth of about nine or ten inches, the edge next the axle being cut with a perpendicular face, while the outside one is cut slanting from the top to the bottom, leaving the top edge, from two to three inches wide, the thinnest. It is generally made about thirty feet in circumference, and in four parts, of millstone grit, clamped together when laid down with iron clamps. On the top of the outside edge is placed some woodwork technically called "curbing," of the same thickness as the edge of the trough at bottom, but finishing off with nearly a sharp edge. Its object is twofold: first, to prevent the fruit and pulp from being carried over, and, secondly, to correspond with the planking which covers the nut in the centre.

The *bruising-stone* or roller, made of the same material as the trough, is generally made from four to five feet in diameter, and nearly the same width as the trough, flat on the side next the centre, but a little convex on the other. In the centre of the runner is placed a strong wooden axle, connected by means of a strong iron rod with an upright axle in the centre of the stone trough. This rod projects far enough from the outside of the runner to connect by means of another iron rod with a wooden bar, which is also linked with the upright axle, and to which is fastened the horse. The height is easily regulated by a bed of concrete or stonework under the trough.

The *cog-wheel,* about two feet in diameter, is fitted to the horizontal axle, and runs on the woodwork which covers the whole space between the interior edge of the trough and the perpendicular axle, and is called the

nut. The teeth of this wheel link into upright teeth fixed in the nut, and thereby force the roller to take a rotatory motion. The diameter of the wheel will of course be regulated by the centre of the roller above the nut.

The perpendicular *axle* has an iron pin at each end for pivots which run in a sunk iron centre; the wood of the axle, being bound with an iron ring, forms the shoulder.

In addition to the mill, there will be required a stirrer, a reever, and a shovel.

The *stirrer* is a strong stick by which the boy who attends to the horse and walks before the stone removes the pulp and fruit from the sides to the bottom during grinding. The *reever* is a piece of board, made of the same shape as the section of the trough, fastened to a wooden handle, and is used to draw the pulp together in the trough previous to its removal by the *shovel*, which should also be of wood.

The reason for using wooden implements has been stated above. This mill is now greatly used in all the cider-making districts in England and the Channel Islands, and is by many eminent makers and connoisseurs considered the best, as no metal comes in contact with the juice expressed, and the fruit and kernels are thoroughly pulped. Its chief disadvantages are that the fruit is apt to roll before the stone roller, and so not get properly crushed, unless well looked after, and that there is considerable trouble entailed in removing the cheese from the trough.

Latterly there have come into use many smaller machines, worked either by steam or horse power, or manual labour. They are all modifications of one form, and the best of them appears to be the following:—

On the top of a stout iron framework is fitted a large hopper or feeder. Under this, driven by a drum from the source of whatever power may be used, are two wooden rollers closely studded with iron teeth or knives, which cut, or rather scrape, the fruit into a fine pulp. This pulp passes underneath to two fluted stone rollers, generally granite, which are made to revolve at different rates of speed, and which crush the kernels that may have escaped the cutting action of the cylinders above. From these the pulp passes into a tub placed under the machine to receive it.

By whatever means used, this machine gives a great saving of time and power over the old mill; but in the eyes of many connoisseurs it is looked upon with disfavour, on account of the iron knives used in the two upper cylinders; and upon the whole it is doubtful whether the economy of time and labour saved by its use is not a false one, by reason of the temptation to rush everything through the mill at one time which is to be ground.

In America this machine, or one of a similar character, has now come into almost universal use.

In France, owing to the small size of the orchards, the mill is generally worked by manual labour. Like the old English

mill, the former favourite among the Norman cider-makers was of stone, and consisted of two grooved cylinders of stone having teeth in them, which crossed each other, and were made to revolve by means of two arms crossing each other, and having attached to each end a heavy leaden weight. At the top was a hopper, in which the fruit was placed to be ground. The whole piece of apparatus was very similar in appearance to a modern turnip-cutter, and, like that implement, was mounted on a platform with wheels, by which it could be moved from place to place.

Latterly this mill has had to give way to two others, the invention of two engineers at Caen—the Ecraseur Salmon, and the Concasseur Berjot.

The *Ecraseur Salmon* consists of two spur-wheels or cylinders, in which are placed iron or steel spikes of a conical form, and which revolve with an unequal velocity. The fruit, having been broken up by these two wheels, is passed between two channelled granite rollers placed below, which can have the distance between them regulated by means of screws. These two cylinders are set in motion by means of a spur-wheel, placed on the principal axis, running into two fly-wheels, to which whatever power used is applied, and which, working in a train of wheels, causes all four to rotate. When used with horse-power it is said to be equal to pulping one hundred bushels per hour.

The *Concasseur Berjot* is a very simple and ingenious piece of apparatus: two granite cylinders mounted on horizontal axes fixed into a strong wooden framework, a fly-wheel, handle, a spur-wheel, a pinion, and a hopper compose the instrument, which it is stated is equal to pulping one hundred and fifty bushels of fruit per hour when worked by one horse. It also can be used by manual labour, and serves for all farm purposes where pulping is required; such as grinding roots, oil-cake, &c. The cylinders can be set any width apart by means of set screws, and with a strap it is equally available as a thrashing-machine.

In Jersey the cider and perry orchards are going out of cultivation; but where these liquors are still made, the old stone mill as used in England was, and still remains, the favourite instrument for grinding.

In grinding the first lot of fruit, it is necessary, especially in a dry season, to sprinkle a little water over the fruit, and from the first lot ground to express the juice by means of the press, and use that for the successive grindings.

Upon the necessity of bruising the apple-kernels, or the advisability of so doing, great diversity of opinion exists. By all the older cider-makers, and by many of the modern, it was held to be a *sine quâ non* that they should be bruised, if it were wished to make a long-keeping cider of good quality. Science, however, says this is not the case. The whole subject was thoroughly investigated some twenty-five years since by M. F. Berjot, jun., of Caen, the inventor of the Concasseur, who read his report at the fiftieth anniversary of the foundation of the

Caen Society of Agriculture, and was awarded a prize for the same. In it he says:—

"For all cider of the best quality it is not necessary that the pips should be bruised, as by their odour they mask the agreeable flavour so much admired by connoisseurs in those vintages; on the contrary, for second-quality cider it is an advantage to bruise them, as by so doing those vintages obtain a bouquet and flavour they otherwise would not have. For the manufacture of cider destined to be converted into brandy it is indispensable. The essence of the pip imparts to the young brandy a flavour of noyau, which after a time becomes decomposed into benzoic acid, and gives to old cider brandy that balsamic perfume so much admired and sought after by *bons vivants*."

After the pulp is made it should be allowed to stand for ten or twelve hours, or, better still, twenty-four, if possible, before it is put into the press. For this purpose large wooden tubs or vats are used, which are filled to within a foot or eighteen inches of the top, and which at the end of the time mentioned will be found covered with a white froth. The reason for this operation is as follows: the juice of the fruit and the pulp contain, in common with all other vegetable juices, a great quantity of sweet mucilage, which cannot be taken up by the act of fermentation itself, but by this initial process an albuminous substance susceptible of becoming so is formed, after having been subject to the action of the air. The operation also assists the colouring of the cider, as a reddish-brown colouring matter is developed in the cheese, which colour is imparted to the liquor, and adds considerably to its aroma. Provided the temperature of the house in which the pulp is put is not high—say about 40° to 45° Fahrenheit—it may be allowed to stand several days with great advantage, the scum which forms on the surface keeping off the action of the air and thus preventing acetous fermentation.

The pulp having been allowed to stand for some twelve to twenty-four hours, as above stated, will now be ready for the press. The press used is a modification of the ordinary cheese-press in use on all dairy farms, and consists simply of a frame-work, with a stout board at the bottom, on which the pulp is placed, and a stout screw at the top to apply the pressure. All being in readiness, a stout cider-cloth, made of horsehair, about four feet square, is placed on the board, and on this is placed sufficient pulp to allow the corners of the cloth to be folded over and nearly meet in the centre on the top; over this is placed another lot of pulp, and so on until the press is full. In Devon and Somerset they put clean straw also between each layer, technically called the cheese. Pressure is then applied very gradually until the cheese is dry. As the liquor runs it is caught in a pail and carried to a large wooden cask, in the West Midland district generally holding from about 100 to 120 gallons,

but in the Western seldom more than 60. This cask is nearly filled, a little ullage space being left for fermenting purposes. If the cheese is not further required it is thrown on the muck-heap; but if it is wished to make small cider—"ciderkin," "purre," or "washings" as it is called—the must is laid by and reground with a small quantity of water, and makes drink for immediate consumption.

Before entering upon the details and precautions to be observed during the process of fermentation, it would perhaps be as well to describe shortly what that process is.

All saccharine juices are capable of four different kinds of fermentation, viz. vinous, acetic, viscous, and putrid; the first and third of which are certainly due to the action of microscopic fungi; the second may be so, but as the arguments *pro* and *con* are numerous and strong, and this paper not long enough to contain a dissertation upon the subject, it will be treated as a chemical one; while the fourth is due to the presence of "bacteria," which are small microscopic organisms having motion, but whether animal or vegetable is unknown.

Vinous fermentation is that particular change which all native saccharine juices are liable to undergo when exposed to the air and left to its normal temperature. If a small quantity of these juices be carefully filtered through filtering paper and rendered bright, they may be left to themselves for an indefinite period and no change takes place, but upon the addition of ever so small a quantity of the unfiltered juices a change sooner or later takes place. This change manifests itself in the first place by a thickness and turbidity in the liquid which is owing to two causes: first, the evolution of carbonic acid; and, secondly, the formation within the liquid of a finely divided solid, which through the evolution of the gas is partly kept in suspension in the liquid and partly thrown up to the surface, which is known as yeast.

During this process an effervescence of a more or less disturbing character takes place, sometimes taking the form of a violent ebullition, the temperature of the liquid itself rising above that of the surrounding air, and the yeast becoming more abundant. Sooner or later a climax is reached, effervescence ceases, when the yeast settles at the bottom as a slimy deposit. Above this the liquid is clear and bright, and upon the top of the liquid there floats a mass of cellular tissue, supported mainly by the bubbles of carbonic acid gas given off. On tasting the liquor now the flavour will be found to have changed, and instead of the sweet taste it formerly had there will be a decided vinous one.

This change is due to the action of the yeast-plant, a micro-

scopic fungus, named *Saccharomyces pastorianus*, after the distinguished French savant M. Pasteur. Like most organised beings it lives by absorbing oxygen from the air, but being unable to obtain more than a very small quantity of that gas in the liquid in which it is immersed, it obtains the oxygen from the sugar, and in decomposing the sugar sets free more oxygen than it requires. This free oxygen unites with the carbon and hydrogen present, and forms the various products of the fermentation. The yeast-plant is not a product of the fermentation, but the cause of it, the plant, as above stated, being always present upon the skin of the various fruits used.

Having thus considered the only fermentation which the cider-maker wishes to see, we will describe the process which he will have to carry through to a successful issue. In this, great care will have to be taken with the temperature of the barn or cellar in which the fermentation is carried on. If possible, the temperature should be sustained at from 55° to 60° Fahr., not letting it fall below 50° or rise above 75°, as in both cases the operation will cease. Should there be any tendency to fall, the temperature can easily be raised by means of a small portable stove, with a fire in it, which is the method adopted in France. Supposing every condition favourable, in about a week fermentation will have ceased and the liquor will be fine, having on the top a thick floating mass of skin and pulp, and the bottom a thick ropy mass, being in the condition which is known as "lying between the two lees." This is the favourable moment for "racking" it, and the operation is best performed with a siphon, the thick portion at the bottom being filtered clear through proper filtering bags and added to that already drawn off. The cask into which it is racked must be perfectly clean and free from any smell whatever, and afterwards the temperature be kept low. A considerable ullage should be left in the cask in case secondary fermentation should set in, when the whole operation must be repeated.

The entire operation is a crucial one, and will test the cider-maker's watchful care and management to the utmost, for the most skilful operators cannot always command success at once, many causes operating against it. The season may have been bad, and the fruit not ripened properly; the fruit may have fermented in the heaps, become frost-bitten, or rotten; it may be poor and watery; the temperature may be too low at the time of making and retard fermentation, or even stop it altogether, or it may be too high and carry it through too quickly, although with proper buildings this is to a very great extent under the maker's control; lastly, there may have been a want of cleanliness in the vessels or implements used. This latter may be

considered fatal, and is certainly under control. Let the ciderist take heed and pay as much or even more attention to his cider implements during the process of making as the dairy farmer does to his dairy utensils.

From the above remarks it will be gathered that vinous fermentation may be of three different degrees—viz. too active fermentation, which takes place when the juice is rich in saccharine matter, and the temperature high; dilatory fermentation, which may be caused by poor juice or a sudden spell of cold weather; and persistent fermentation, or, as it is technically called, "fretting," which, however, arises mainly from the inferior quality of the fruit, and therefore of the juices yielded by them. The first need not cause much trouble, its worst evil being the waste of the liquid: the only remedy is to cool the temperature as much as possible, by allowing a current of air through the house or cellar, sprinkling the floor with water, throwing wet cloths over the barrels, or any other method which may suggest itself. The second is much more difficult. If it arises from too low a temperature, that can, as already stated, be very easily overcome by closing the house or cellar and lighting a stove or two in it. Should this not be found sufficient, the French method may be adopted of taking two or three gallons of juice out of the cask, heating it to about 70°, and then returning it, stirring it up quickly with a bundle of osier twigs.

"Fretting," or persistent fermentation, is much more difficult to overcome, as the root of the evil is in the juice itself. Should it continue for any length of time, the saccharine matter becomes exhausted, and the liquor becomes acid. As soon as this occurs, the fermentation must be stopped at any cost, and in order to do this one of the yeast-destroying agents must be used. These are: sulphur, salicylic acid, sulphurous acid water, bisulphate of soda, or lime, and many others. The ones principally used both in England and abroad are the two first, and of these two the second is the easiest to manipulate, and has come much into favour. When used in proper proportions it is perfectly harmless, and free from all objectionable smell or taste. When used in a concentrated form, from one ounce to one ounce and a half to every hundred gallons of liquor is the proportion, and it is poured into the liquor immediately after racking. Should any iron be present, however, it will turn the liquor black. Sulphuring was formerly universally used, and its method of application is very simple.

A little sulphur is melted, and into this is dipped a strip of clean canvas or linen about a foot long and two or three inches wide. This is taken out and allowed to harden. It is then tied to a stick or piece of wire, lighted,

and inserted in the cask into which the liquor is to be racked, and allowed to burn until it goes out. The cask is then full of sulphurous fumes, and while in this state the liquor is run in. This absorbs the sulphurous acid gas, which kills the yeast-plant without retaining any taste or smell.

If fermentation should again set in, the operation must, of course, be repeated. The use of chemicals, however, and the endeavour to make good liquor from bad juice is the rock upon which cider has split and got its bad name. The best cider-makers never use them, and it may be laid down as an axiom that cider or perry is pure and good in the inverse ratio to the amount of chemicals used in its manufacture.

Acetous Fermentation.—It is well known that all weak fermented liquors, when exposed to the action of the air for any length of time, become sour and turn to vinegar. As has been above stated, this will be spoken of as a chemical reaction, although M. Pasteur asserts that it cannot take place without the presence of a small microscopic fungus, called *Mycodermes aceti*. The chemical action, whether due to the presence of the fungus or not, is as follows: the alcohol in the liquor absorbs oxygen from the air and forms aldehyde and water; but the aldehyde in ordinary acetous fermentation never appears, the aldehyde taking up oxygen from the air at once and forming acetic acid. The fungus is visible to the naked eye, when in large quantities, as a blue mould on the top of the liquid, which at length sinks, and is then well known as the vinegar plant.

Viscous Fermentation, or Ropiness.—This peculiar change which sometimes accompanies vinous fermentation manifests itself by the liquor becoming thick and viscous to such a degree that when poured from one vessel to another the liquor draws into long threads. According to Pasteur, this is due to the presence of a very minute fungus with spherical cells, which has not as yet been named, but which has the property of changing the glucose into a kind of gum, which is always accompanied by mannite and the evolution of carbonic acid gas. In some seasons this fermentation is very troublesome, and unfortunately the remedies recommended to cure it are as bad as the disease.

Putrid Fermentation.—This is not a fermentation at all, but is due to the presence of *bacteria* and *vibriones*, whose position in the world of life has not yet been determined. Suffice it to say that their germs are always present in the air, ready to seize any opportunity which may present itself favourable to their growth, and that, although there is no cure for this kind of fermentation, it may be prevented almost entirely by scrupulous cleanliness in all the operations of making.

The method of treating the liquor in France during and after fermentation is much the same as that above given, with two slight modifications. One of these is the addition of a small quantity of catechu, about 8 ozs. to 100 gallons of the liquor, when racked off; and the other the fumigation of the casks, which is always done, preferably by burning a little alcohol in them, or, should their condition be deemed at all doubtful, by burning sulphur. In the Channel Islands fermentation is allowed to take place in open vessels, the vessels being simply covered with a cloth, and the scum removed as it is formed. The clear liquor is then racked into sulphured casks, and if fermentation should again set in the operation is repeated. In America the same method as that adopted in England is usually carried out, with the addition of a little finely powdered charcoal to each barrel when the liquor is racked off.

After fermentation, the liquor will not always be found sufficiently clear, owing to the mucilage present, as the richer the juice the greater difficulty to obtain a bright liquor. In order to clear it, it is only necessary to dissolve from 1 oz. to 1½ oz. of isinglass in a little of the cold liquor and add it to the cask. This quantity is sufficient for 100 gallons. The same amount of fish glue, or the whites of a dozen eggs, will answer the same purpose.

It will be noticed in the list of apples given that against some of them is placed the remark "Cider turns black in the cup"; this is due to the presence of a salt of iron in the liquor. The iron may not have necessarily come from any contact of the juice with that metal during the process of manufacture, as, according to experiments made in France, it appears that some particular kinds of fruit grown on a red soil take up the iron from it.

The liquor having been safely carried through its process of fermentation, nothing now remains for the cider-maker but to let it stand in the casks, at as an even temperature as possible, until the following spring, when it should be either racked off into smaller casks to be sent out to the consumer, or bottled. In racking off into smaller casks, great care should be taken that they are perfectly clean and free from any smell. They should be absolutely without odour, or the liquor will take it up, when all the labour and care previously taken will be lost, for no fermentation or re-racking will bring back to the cider its agreeable perfume, when once lost.

In bottling, the best bottles to use are champagne ones, as they are much stronger and not so liable to burst as those of other shapes. Good cider will keep in cask four or five years, and formerly it was the practice to bottle the liquor when it was

a twelvemonth old—that is to say, the cider made in the autumn of one year was bottled in the winter months of the following year. This practice, however, has now become obsolete, and it is the general custom to bottle the liquor in the April and May after it is made. A few more bottles are burst probably by this arrangement, but the liquor gains in richness and comes more quickly into the market. The best method of bottling is to remove the bung out of the cask the evening before, and, the bottles all being ready, in the morning to draw off and fill them all before commencing to cork. The corks must be of the very best quality, and after corking and wiring, the bottles should, if possible, be put in sand for a short time before laying them down in the bins. Many small makers, when laying down for their own consumption, rinse the bottles out with a little brandy, draining each bottle as dry as possible, a bottle of brandy being sufficient for a cask of cider. In France this is a general custom.

Perry.—The process of making perry differs somewhat from that of making cider. In the first place, as a general rule, pears are fit for grinding as soon as they fall from the tree, and, therefore, with the exception of a few late sorts, they must not be placed in heaps where they would rot and ferment, but be carried straight from the trees to the mill. After grinding and pressing, the liquor is fermented in open vats, and as soon as the active fermentation has subsided and the liquor is lying "between the two lees" it is run off into casks and treated in exactly the same way as cider. Theoretically this is perfect; but in practice it will be found that perry, in nineteen cases out of twenty, never fines so well as cider between the lees because of the greater quantity of mucilage perry contains, so that, in order to fine it, it is necessary to filter the liquor through "forfar" bags.

Having thus far brought the whole question from the sorts of fruit used to the bottling of the liquor before the reader, it only remains to consider that very essential side of the question, namely, the paying one. Here statistics are of no avail, so the writer will endeavour to give the opinions of a few practical men who have made the subject the consideration of their lifetime.

Much, of course, will depend upon the grower himself, whether he really puts his whole energies into his fruit-trees, fully resolved to make them pay, or whether he simply looks upon his orchard as quite a secondary consideration, and cultivates it in a *dilettante* sort of way. As a rule, the best cider has hitherto been generally made by small growers who are

dependent to a very great extent upon their trees for their livelihood, the large farmers, with few exceptions, not giving the subject sufficient attention.

The price of cider and perry, like that of everything else, depends upon its quality, condition, and the kind of season it has been, good, bad, or indifferent. At the present time the price of best-quality cider in cask is about 1*s.* 6*d.* per gallon, and the same quality bottled will realise say 10*s.* per dozen. Second-quality cider, for household use, on draught, will realise 8*d.* per gallon, while ciderkin, or "purre," for farm use, will sell at about 2½*d.* per gallon, and perry about the same prices. These prices vary but little from year to year at the time of production and sending out, that is, from November to the following April or May; but after bottling, prime cider of a good vintage year will fetch a high price. The writer has seen both cider and perry realise 30*s.* per dozen at public auction, and some cider and perry which had been forty years in bottle could not be purchased at any price. One pound a dozen is not at all an uncommon price for first-rate cider or perry the first season's making.

Taking the orcharding on a farm at fifteen acres, this area, if planted in the manner described in this paper with good sorts of fruit, will contain about 750 trees. Of these a few, as the Cherry Pearmain, &c., will be of use as soft fruits, so one sixth may be taken from them. This would give 625 trees the fruit of which would be available for cider- or perry-making. Taking an average of years, these trees would yield 100 hogsheads or 10,000 gallons of liquor, which at the moderate price of sixpence per gallon would be worth 250*l.* In addition to this there would be the soft fruit for sale, and the profit which may be obtained from the ground upon which the trees grow.

It has always appeared to the writer a very great pity that, besides the neglect shown to the orchards, such very little attention is paid to provide suitable buildings throughout the orchard districts of England in which both the fruit and liquor could be stored. In both France and America they are far before us in this respect, every orchard farm being well supplied with proper buildings. In the latter country, by means of simple contrivances, they manage to keep their fruits at a temperature just a little above the freezing point, in such a condition that they can be placed upon the market at any time; and upon farms where cider and perry are made these houses are used for manufacturing and storage purposes.

The writer has been favoured by Mr. H. C. Mewburn with the following description of the orchard and cider houses in Canada, which will probably be found of general interest:—

"I will describe the premises which I occupied some years ago when I used to make cider. There was a large barn, in which the apples were stored round the sides; on the floor was a cider-mill, which was worked either by hand or horse-power. Under the floor of the barn was a large cellar, round which were placed the cask and vessels to be used in the making. As the fruit was ground, it fell through the floor and was passed into casks or tubs placed to receive it until it had commenced to ferment. In the centre of the cellar was the press."

The process afterwards adopted was exactly the same as has been described previously in this paper.

That similar buildings should be provided upon all fruit farms in England there can be no two opinions; but how they are to be obtained is quite another matter, although one which should be seriously entertained by both landlord and tenant. The buildings themselves need not be expensive; plain thick walls of stone, or double walls of brick, with a good thick thatch, would answer every purpose; and where possible the building should be so arranged that the liquor should not have to be carried at all from the press to the casks, but should be allowed to flow by gravitation to those vessels in which it is to be fermented, and then be racked off into the other casks, in which it is either to remain for bottling purposes or to be sent to the consumer.

Cider and perry factories have for a long time—considerably more than a century—been talked of, and the subject is one well worthy the consideration of a cider- or perry-producing district. The capital required would not be large, and in a year when a good hit of fruit took place it would all be used, instead of the greater part wasted as at present. It is precisely at such a time that the want of such factories is felt, because a good hit means not only a good crop, but the crop well ripened and in good condition, and therefore first-rate liquor. At the present time many farmers and cider-makers will buy up all the first-class fruit they can lay their hands upon, or, at any rate, as large a quantity as will fill the casks with liquor which they can store; but they will not look at fruit of an indifferent quality, which proves the necessity so strongly insisted upon in this paper of growing none but known and approved sorts.

In all the above operations cleanliness is above all the one thing needful. Without it, no matter what care has been bestowed upon the other operations, all the labour will be in vain. The greatest attention should therefore be paid to every machine and utensil used for the purpose of making or receiving the liquor. Attention should be given to the temperature of the house in which fermentation is carried on, keeping it as near 60° Fahr. as possible. Water should never be added to the liquor in order to make more of it, and, above all, chemicals

should in no circumstances be used in any of the processes, unless as a last resort.

This is a question which strongly affects all agriculturists, whether owners or occupiers. Corn and cattle nowadays hardly pay for rearing or growing, but orcharding and the production of cider and perry is one of the many smaller farming operations which will well repay attention. Rents possibly are higher and our seasons more uncertain than those of France and America, but these disadvantages are counterbalanced by the smaller expenses of packing and carriage and loss from deterioration or injury. In the neighbourhood of large towns there is always a sale for hardy fruits, and those who have not that advantage can turn their energies to cultivating these fruits for cider and perry purposes. There are many advantages attending it, especially at the present time. There are now no restrictions whatever on the production of these liquors by taxation, or on their sale direct from the orchard, and the small amount of alcohol which they contain will always militate against their conveyance from a distance.

Every encouragement should be given to the practice of fruit-growing on an estate, and, if possible, the subject should be taught in elementary schools. The late Professor Henslow introduced the subject in his village school in Cambridgeshire, and the writer owes his taste for it to the fact that, as a choir-boy in Oxford, he was given a small patch of land at the back of the school to cultivate in common with the other boys, who had similar patches, and which was a source of endless amusement and also a little profit. The keen competition of the present day must be met by the farmer with greater economy, higher cultivation, and indomitable perseverance, and by attention to these there is little fear but that the British farmer will hold his own.

IX.—*Report on Miscellaneous Implements at Newcastle.* By DAN. PIDGEON, Assoc. Inst. C.E., Holmwood, Putney Hill, London, Reporting Judge.

Judges.

J. W. KIMBER, Fyfield Wick, Abingdon.
JOHN COLEMAN, 7 Park Street, The Mount, York.
JAMES A. CAIRD, Northbrook, Micheldever, Hants.

THE condition of English agriculture, coupled with the vast increase of foreign implement-making, are, doubtless, together responsible for the considerable diminution of exhibits which characterised the implement department of the Newcastle Show.

That diminution was, indeed, heralded, first, by a request, addressed to the Royal Agricultural Society of England by the Agricultural Engineers' Association in the autumn of 1886, for a reduction in the price of shedding, and, afterwards, by an agreement entered into between the makers to curtail their exhibits at Newcastle, because the Society had not felt able to comply with their wishes.

It is, however, certain that the desire to save a few pounds expenditure upon an Exhibition, which is universally regarded by implement-makers as the best and cheapest possible form of advertisement, has had little or nothing to do with the contraction in question. The times are so "hard" that many a British farmer makes shift with old tools instead of buying new, and, meanwhile, the great implement factories which during late years have sprung into existence on the Continent are supplying many wants that used to be filled by English makers.

The Showyard is not now, indeed, what it once was—a mart, which the farmer visited annually for the purpose of selecting and purchasing his own machinery; for, with the increased and increasing use of implements, he finds it convenient to buy what he wants of the local agent, who, besides keeping a large and varied stock of the best tools, has his stores always full of spare parts, easily and instantly accessible in case of need.

But, while no longer a great retail shop, the Showyard has become almost indispensable, both to the manufacturer and the useful "middle-man"—a place where experiences, gathered from every county, crop, and soil in the kingdom, are placed at the service of the mechanic, insuring important and rapid improvement, and where personal intercourse tightens commercial bonds.

The Royal Agricultural Society of England, on the other hand, is more alive than ever to the need of encouraging by every means in its power, not only failing agriculture itself, but the development of every aid to agriculture, so that if, at the moment, implement-makers are over-economically inclined, this mood is the child of the "hard times," and not of any churlishness on the part of a Society which is acknowledged to be their most useful friend and ally.

It may, indeed, be taken for granted that although the implement shedding at Newcastle was of only two-thirds its usual area, while machinery in motion occupied little more than half its usual space, the serious "agricultural depression" characterising the present time is the true reason why the implement-maker on this occasion "cut his garment according to his cloth" more closely than was his wont in the prosperous

days, for whose return the implement-maker and implement-user alike wait.

PRIZE IMPLEMENTS.

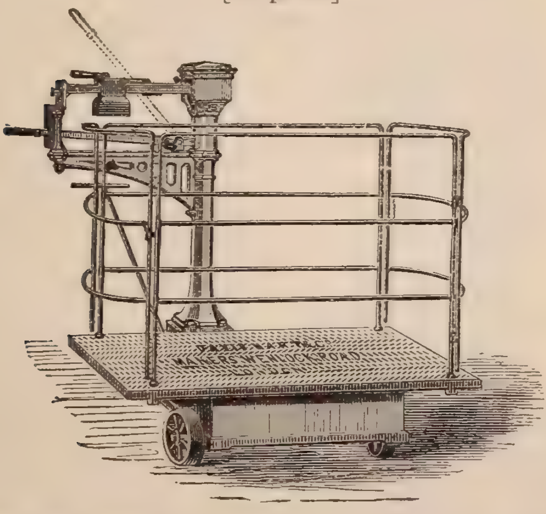
Prizes were offered at Newcastle to eight different classes of machinery, viz.:—

CLASS 1.—Compound Portable Agricultural Steam Engines, self-moving or otherwise.
CLASS 2.—Simple ditto ditto ditto.
CLASS 3.—Weighing Machines for Sheep and Pigs.
CLASS 4.—Ditto ditto for Cattle.
CLASS 5.—Potato Planters.
CLASS 6.—Potato Raisers, price exceeding 5*l.*
CLASS 7.—Ditto price not exceeding 5*l.*
CLASS 8.—Manual Power Cream Separators.

A special report published in the last number of the 'Journal' describes the trials which took place, and the awards which were made in Classes 1 and 2. The trials of Classes 6 and 7, being necessarily postponed till autumn, are the subject of a separate paper in the present number by the highly competent

Fig. 1.—*David Hart & Co.'s Weighing Machine.*

[See p. 198.]



pen of Mr. John Coleman, one of the Judges, whose recent death all agriculturists and readers of the 'Journal' will deplore. In Class 5 the prize was withheld.

In Classes 3 and 4 the Judges awarded the prize of 20*l.* for a weighing machine for sheep and pigs, together with the prize of 25*l.* for a weighing machine for cattle (Arts. 2304 and 2305),

to Messrs. David Hart & Co., of North London Iron Works, City Road, London. Both machines are alike in construction, the former having a platform 72 in. by 34 in., and weighing up to 21 cwt.; the latter, a platform 45 in. by 25 in., weighing up to $6\frac{1}{4}$ cwt.

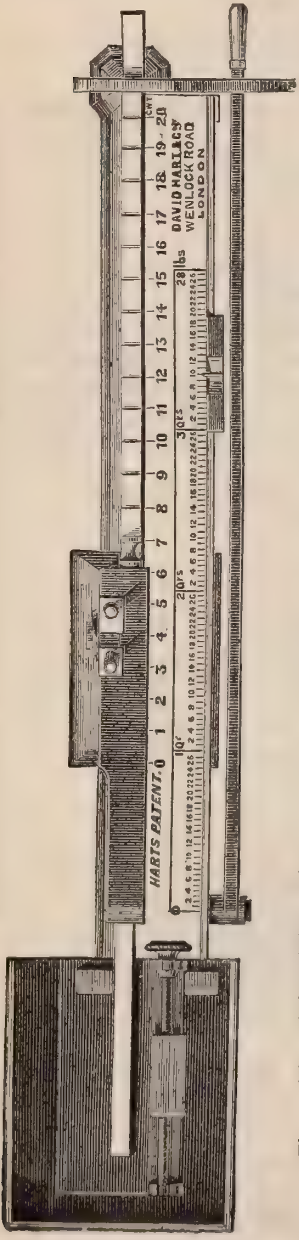


Fig. 2.—Plan of Steelyard, showing the manner in which the Weight of Goods is Indicated.

The position of the sliding weights in this engraving indicates that the weight on the platform of the machine is 7 cwt. 3 qrs. 10 lbs.

Fig. 1, on p. 197, shows the general appearance of both the prize machines, the special feature of which is the absence of all loose weights.

The goods are weighed by means of two weights sliding on the steelyard, one representing cwts., the other lbs. When both are at zero, they balance the platform and other working parts of the machine. When in use, the large weight is first slid along the steelyard, until it almost balances the goods. Afterwards the small weight is moved, until a perfect balance is obtained, the exact weight of the goods being indicated by the position of the sliding weights, in cwts., qrs., lbs., or any other desired standard, on a plainly engraved scale (see fig. 2). This arrangement prevents mistakes, and obviates the necessity of calculation. As the weights are never taken off the steelyard, they cannot be lost, or mixed with those of other machines.

When the machine is out of use, or is being loaded or unloaded, wear and damage to the centres are prevented by a relieving apparatus which unhooks the steelyard, disconnecting it from the working parts of the machine, at the same time lowering the platform on to solid supports, and the levers to the bottom of the box or frame.

The frames are made with solid, close bottoms to exclude damp, and all the centres work in cups of oil. The platforms are suspended on a universal joint, and swing freely in any direction, without grinding or damaging the centres, or disturbing the levers or any of the under parts.

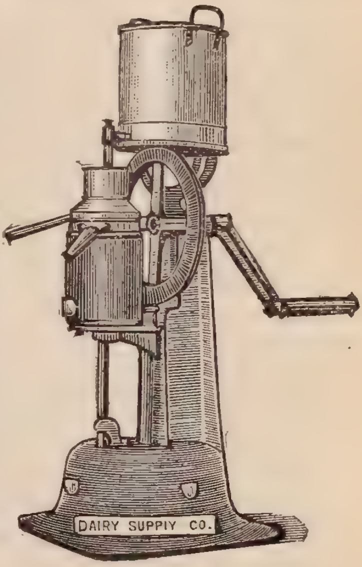
A special weight, not shown

upon either of the drawings, balances the hurdle, and when this is removed the weight in question is taken off also, the platform, without the hurdle, being thus instantly equilibrated without the chance of error arising in making a special adjustment.

In Class 8, the prize of 25*l*. for a one-man power Cream Separator, price not to exceed 20*l*., and to be capable of dealing with 20 gallons of milk per hour, fell to G. D. Laval's Hand-power Separator (Art. 971), exhibited by the Dairy Supply Company, of Museum Street, Bloomsbury, London.

Fig. 3 below shows the general appearance of the Laval Hand Separator, whose various parts and their action will be readily understood, without further explanation than the drawing supplies, now that the centrifuge is so well and generally known.

Fig. 3.
Laval's Hand-power Separator.



This machine, when under trial, separated milk at the rate of $23\frac{1}{2}$ gals. per hour, one man turning the machine for 41 minutes 45 seconds, at the rate of 40 revolutions of the handle per minute. At this speed, the milk-vessel made 6,400 turns per minute, and the work did not appear hard for the man. Dynamometer tests demonstrated that the machine absorbed 4,455 foot-pounds of energy per minute, which may be considered as a moderate effort for a man working in short spells of, say, one hour, seeing that a man can exert about 3,200 foot-pounds of effort per minute, working 8 hours a day on a winch.

The separation was good, but the milk unfortunately not in good condition, so that particulars of Dr. Voelcker's analysis of the skim-milk are omitted as likely to mislead. There was great difficulty in getting milk in proper condition at the Newcastle Show, owing to the distance of the source of supply.

Two other hand-centrifuges, viz. Laval's Horizontal Separator (Art. 972) and the "Danish" Hand Separator (Art. 721), the former exhibited by the Dairy Supply Company, Limited, and the latter by the Aylesbury Dairy Company, Limited, were entered for competition. The "Danish" machine was accident-

ally injured, and so failed to put in an appearance; but Laval's Horizontal Separator was tested by the Judges.

In this machine, the milk-vessel, which is bottle-shaped, lies horizontally, and is carried upon very ingeniously designed bearings, described below, from which it is easily detachable for the purpose of cleansing. It is driven by a combination of toothed and frictional gear, the first motion consisting of a wheel and pinion, while the second motion, giving the greater part of the increase in speed, is frictional. Each end of the spindle of the milk-vessel is furnished with a small friction roller, not much larger or thicker than a penny, and having a rounded edge. These rollers turn upon the flat peripheries of two large wheels, the contact of their respective edges being regulated by a slight pressure given through india-rubber washers.

Simple and excellent as was the general appearance of this arrangement, and neat as is the whole design of the horizontal separator, it failed to satisfy the Judges. The work was only fairly done, too much butter-fat being left in the skim-milk, and the power required was too great. Not only did the man show signs of fatigue, but the dynamometer indicated that 6,250 foot-pounds of energy were being absorbed per minute, an amount considerably in excess of one man's power. It is but fair, however, to say that this result *may* have been due to some maladjustment; for the exhibitors emphatically declare that, in general practice, this machine runs lighter than the other, and seem themselves to prefer it to the vertical separator. However this may be, it certainly exceeded one man's power at Newcastle, and was therefore *hors concours*.

Silver Medals.

The following implements were considered sufficiently meritorious to justify their recommendation to the Implement Stewards for silver medals, which were granted:—

1. Barnard and Lake's Improvements in Thatching Machines.
2. Mayo's Straw Trusser, or Bolting Tier.
3. Fowler & Co.'s "Anti-balance" 5-Furrow Steam Plough.

In addition, General Brigg's Turnip Thinner (Art. 640), and the "Jersey" Creamer (Art. 913), a new implement exhibited by Thyss, Lockyer, & Co., of Euston Road, London, were recommended by the Judges for trial next year.

Fowler & Co.'s Anti-Balance Plough is not a new implement, and was fully described in the 'Journal' for 1886 (Vol. XXII. p. 562), so that it needs no further notice here.

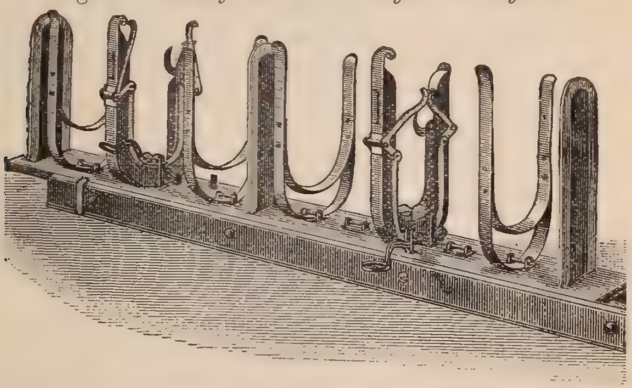
Messrs. Barnard & Lake, of Rayne Foundry, Braintree,

Essex, exhibited the same Thatch-making Machine (Art. 519) as that to which the 25*l.* prize of the Royal Agricultural Society was awarded at Norwich in 1886, improved in certain particulars. The Judges of miscellaneous implements recommended these improvements for a silver medal, which was granted.

The machine itself was fully described in the 'Journal' for 1886 (Vol. XXII. p. 529), and needs no further notice. The improvements in question are twofold. The straw, or reed, was originally supplied to the sewing needles by hand, and the attendant had to be very careful in order to prevent the feed from becoming intermittent. A feed-roller, driven by gearing, has now been added to the machine, and materially diminishes the need for constant watchfulness on the part of the man in charge. The stitching-twine, which was previously used without any dressing, is now drawn through a mixture of tar and petroleum before entering the needles. These two apparently trifling changes have considerably enhanced the value of this clever and useful machine.

Thomas T. Mayo, of Llangunnock, Ross, Herefordshire, showed a "Straw Trusser, or Bolting Tier" (Art. 420), manu-

Fig. 4.—*View of Mr. T. T. Mayo's Bolting Tier.*



factured by Kell, Meats, & Co., of Ross, to which, after trial, both with loose straw and behind one of Ransome's thrashing machines, the Judges awarded a silver medal. This implement was shown as a novelty at Norwich last year, described in the 'Journal,' and ordered forward for trial at Newcastle. Having now taken a medal, it will be re-described here.

The function of the machine is that of trussing and binding straw as it issues from the thrashing machine, an object which is accomplished in the following way (see fig. 4):—

A pair of straw receivers, each consisting of three wrought-iron U's, are fastened vertically to a long board, which slides easily upon rollers contained

in a trough-like bed-plate. Each receiver is about the same width as the thrashing machine, and its limits of length are defined by vertical boards, of which one occupies the centre, and other two the ends of the trusser. Of the three U's forming each receiver, two are plain forks, while the third, or central U, is provided with compressing levers operated by the foot, and armed with about two hundred strings, lying each in a groove of its own, for the purpose of tying. When in action, one of the two receivers, say A, is slid underneath the straw shaker, whence it receives the issuing straw, a boy packing this, as it falls, neatly in the U's. When sufficiently full, receiver A is slid to one side, and receiver B, taking its place, begins to receive straw from the machine. The truss already gathered in A is, first, slightly compressed by the levers provided for that purpose, and then tied with one of the strings with which, as already described, the centre U is furnished. For the sake of saving time, each string is provided with a button at one end and a loop at the other, so that "tying" should properly be called "buttoning." After the truss has been removed by the pitch-fork, receiver A is ready to take the place of B for another load. Matters are so arranged that the boy attending A has ample time to tie and get rid of one truss before receiver B is full, and *vice versâ.*

The Judges remark that the trusses were not neatly enough made or tied for purposes of sale, while it would be difficult to insure their being of uniform weight.

Novelties.

Among the novelties exhibited at Newcastle, the following are those of chief interest:—

Messrs. Clayton & Shuttleworth, of Lincoln, showed a small but not unimportant novelty (Art. 15) in the shape of a contrivance for preventing the escape from the mouth of a thrashing machine of such grain as is thrown out by the action of the drum; a quantity always appreciable and, in the case of some wheats, considerable.

A flat sliding-plate, furnished with slots and set screws for fixing in any position, and placed opposite the feeder, covers a portion of the drum-mouth. A second plate is hinged to the front edge of the first, and depends vertically, or nearly so, from it. Upon the slight inclination of this quasi-vertical plate it depends whether grain, flying from the drum, is arrested or not, and very slight changes in the angle it makes with the vertical are sufficient to bring about the required results with grain of various specific gravities.

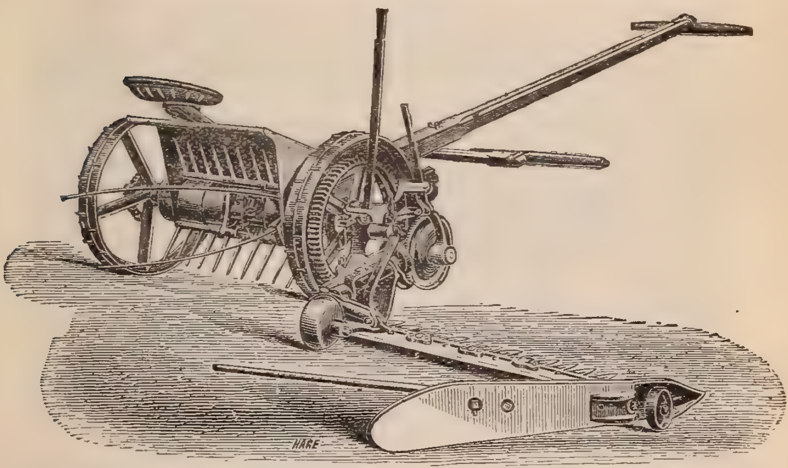
To compass these changes, the short end of a lever, whose farther extremity is pivoted to the framework of the thrasher, is fastened to the hanging plate, while its fulcrum is formed on the flat sliding-plate itself. When the latter is slid back or forth, therefore, the hanging plate moves through a small arc, the relative amounts of the two movements depending upon the relation of the lever arm and fulcrum, which is about 4 to 1. After a little trial and error, the angle of the hanging plate best

adapted to stopping grain is found, when the flat plate is secured in place by means of its set screws.

Messrs. W. J. and C. T. Burgess, of Victoria Works, Brentwood, Essex, showed, as a New Implement, a Mower and Hay Tedder combined (Art. 225). The space between the wheels of the Mowing-machine is occupied by a narrow Haymaker, which, while the grass-mower is cutting one swathe, turns that cut on the previous round. The drawing (fig. 5) illustrates the action of the machine, and the following advantages are claimed for the combination.

The hay is got up in better condition, particularly in showery weather. The thick end of the swathe, as left by the track-board, is broken up and the whole spread loosely over the ground in the best possible condition for air to circulate through it. The use of a separate haymaker is dispensed with,

Fig. 5.—*Burgess's Combined Mower and Hay Tedder.*



and the expense of an extra horse and driver obviated. The wheels do not run on the crop at any time. The wheels of an ordinary haymaker run over the hay, both before and after tedding. The tedding apparatus can be put out of gear when not required, as when the machine is cutting clover, &c. At such times the forks or tines are turned back entirely out of the way of the crop. Very little power is consumed in driving the tedding apparatus.

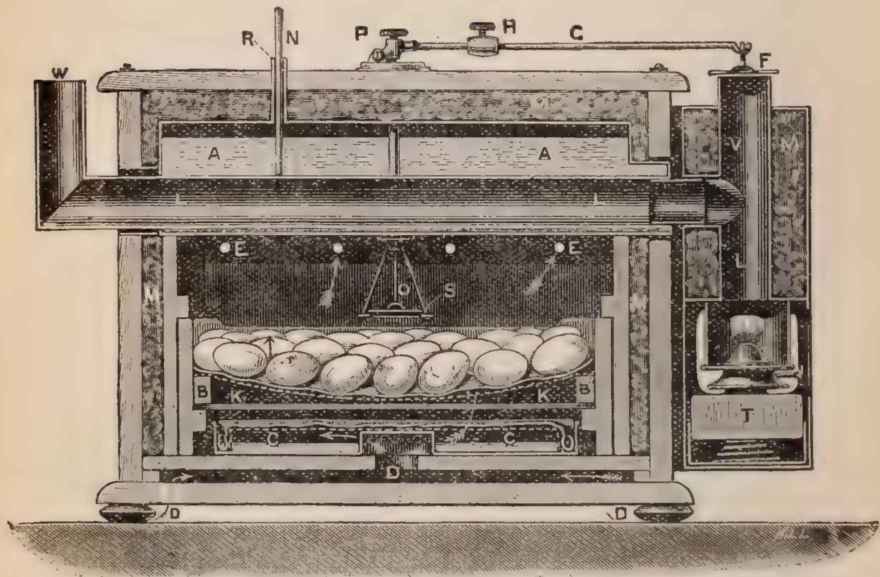
Charles Hearson & Co., of 235 Regent Street, London, showed a simple Thermostat, applied to an Incubator (Art. 444), but useful in any situation where it is desired to maintain a perfectly even temperature for an indefinite time (see fig. 6).

Hearson's thermostat is, in effect, a tiny steam boiler about the size of a postage stamp and thickness of a penny. It is made of very thin brass plate, and, having first been filled with ether, is hermetically sealed. The boiling-point of ether is 94°,

so that whenever the little capsule is brought to that temperature the volatile fluid within it becomes steam, whose pressure causes the flexible walls of the thermostat to bulge like an india-rubber cushion when inflated. Mixing a little spirit of wine, which boils at 173°, with the ether will, of course, increase the temperature at which the "boiler" begins to bulge, and, indeed, the contained liquid should be one that boils at, or about, the temperature which the thermostat is designed to preserve.

The woodcut illustrates the action of this simple device when applied to an incubator.

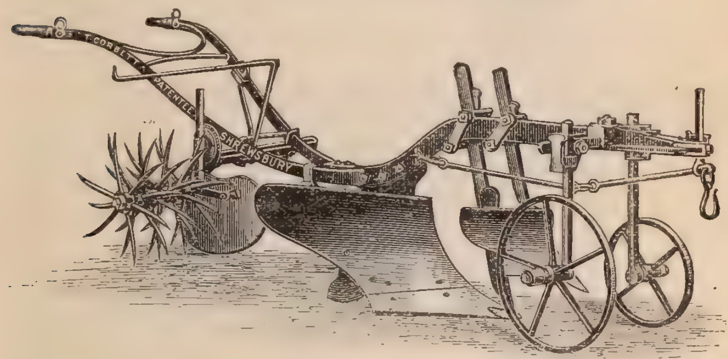
Fig. 6.—*Hearson's Thermostat.*



S is the Thermostat. O, a rod the lower end of which rests on the flat surface of S, while its upper end touches the underside of the lever G, which is hinged at P. and from whose farther extremity depends the damper F. L is a flue, passing through a water vessel occupying the upper part of the chamber to be heated, while T is a lamp, having a chimney, V, closed by the damper F. It is evident that the amount of heat passing from the lamp through the flue, L, would be determined by the position of the damper. When this was lowered, all, and, when raised, almost none of the lamp heat would take the course in question. Now the damper, F, is under the control of the capsule S; when this expands it is lifted, when it contracts it is lowered, and in this way the temperature of the chamber is kept steady at, or about, the boiling-point of the liquid contained in the Thermostat. Adjustments of this temperature may, however, be made by means of the sliding-weight, H.

Thomas Corbett, of Perseverance Iron Works, Shrewsbury, showed a new form of Pulverising Plough (Art. 478), which differs from the "Spider" plough described in last year's 'Journal,' and from all similar pulverising ploughs. Mr. Corbett mounts a small "Norwegian Harrow" on a horizontal axis just behind the plough-breast. The "harrow" consists of 6 six-tined sections, all or any of which may be used at pleasure. The axis is adjustable both vertically and horizontally, and is fitted with a sleeve, having a hexagonal exterior, upon which any chosen number of the tined sections can be threaded. The object of this arrangement is that all the tines in use shall retain the hexagonal division of the circle, and follow each other at regular intervals. A lateral guard is provided in the rear of the plough-breast, which prevents the furrow-slice from slipping away sideways while the harrow is operating upon it (see fig. 7).

Fig. 7.—*Corbett's Pulverising Plough.*



The Aylesbury Dairy Company exhibited as a new implement Johnson's Improved Ensilage Stack Press (Art. 722), to which a few words may be devoted, notwithstanding the fact that this inventor's successive advances in stack-pressing have already occupied several pages of the 'Journal.' (See Norwich and Preston Reports.)

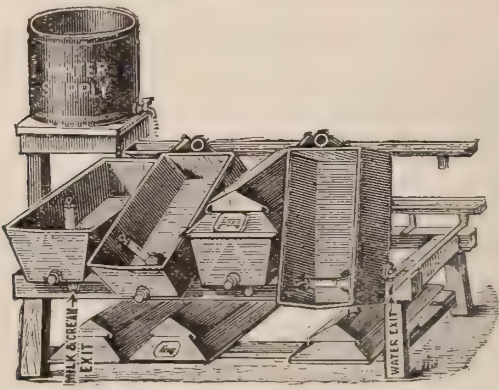
Mr. Johnson's efforts in this direction have, from the first, been directed to the "tight-lacing," so to speak, of ensilage stacks, and his improvements have all consisted in bringing the means for accomplishing this to a higher mechanical standard than that which characterised his earlier plans.

The "Rachet bar," showed at Norwich, which was fully described in last year's 'Journal' (Vol. XXII. p. 535), has given way to a "Rachet drum" at Newcastle. A dozen or so wire ropes, more or less being used according to the size of the rick, placed a few feet apart, are thrown over the stack, and each end

of each rope is secured to a small crab-barrel, provided with a ratchet and pall, and bolted to the timber "sleepers" upon which the stack rests. A lever, common to all the barrels, enables the attendant to rotate them one by one, and so haul in slack, which, when gained, is held fast by means of the ratchet and pall already mentioned. Whether, taking account of the rough-and-ready way in which these barrels must necessarily be fixed to the "sleepers," the wire-rope can be prevented from "surging" on the crab-barrels is a question—a question upon which some light is, perhaps, thrown by the following caution to users, extracted from Mr. Johnson's catalogue :—

"When in use, the ropes should not be allowed to lap themselves on the drum, as otherwise they will be injured by the severe pressure."

Fig. 8.—*Lockyer's Jersey Creamer.*



It is not impossible that a fourth number of the 'Journal' may yet describe some future improvement on the "Ratchet Drum" system of stack silage.

Messrs. Thyss, Lockyer, & Co., of 374, Euston Road, London, showed a new implement (Art. 913), called the "Jersey" Creamer (see fig. 8), which the Judges recommended for trial at next year's meeting.

The milk-pans are double-bottomed, have double sides, and are made, the outside pan of enamelled zinc, the inside pan of tinned steel plates.

The open part of the pan receives the milk, and the empty space between the pan contains, in summer, ordinary cold water (50-55 degrees), conducted into each pan by a brass tap connected with a galvanised tube at the back of the creamer; water being supplied by the pipes on the premises, or, if there be no water supply, by means of an ordinary tank, as shown in the drawing.

The jacket being filled, the water should be kept dripping as long as possible through it; the surplus water escaping from a hole at the back of each pan into a lower trough connected with a small waste pipe at the side.

The action of the water flowing round the pan causes the cream to rise in about 14 or 15, instead of 36 or 48 hours, as with the old systems. In winter, hot water can be used first.

Each pan is fitted with a tube, having at its lower end a very fine wire gauze, through which the skim-milk passes, leaving the cream in the pan from which it is taken by first removing the tube and stopper, and then tilting the pan forward on its hinges.

The Judges attempted a trial of this "Creamer," which, however, came to nothing, because the water supply was turned off during the night, and the experiment thus brought to an end. Similar intermittence in the water supply of the yard caused several delays to the Engineers and Judges of engines during the trials.

The Dairy Supply Company, of Museum Street, Bloomsbury, London, exhibited several novelties of interest, of which the following claim a notice:—

1. Laval's Vertical Hand-Power Cream Separator (Art. 971).
2. Laval's Horizontal Hand-Power Cream Separator (Art. 972).
3. Laval's Improved Power Cream Separator (Art. 974).
4. Laval's "Turbine" Cream Separator (Art. 973).

Of these machines, Nos. 1 and 2 competed in Class 8 for the Hand Separator prize, which fell to the vertical Separator, and they are, together with the trials, described in that portion of the Report devoted to the prize classes.

Referring, in the first instance, to the improved Laval Power Separator, a very simple constructive change is said to have effected a remarkable improvement in the performance of this machine. Hitherto, the rotating milk-chamber has been furnished with a wing, for compelling the rotation of the milk, which wing did not extend to the wall of the centrifuge, and, hence, a portion of the peripheral milk failed to rotate at the same speed as that of the vessel itself. The wing has now been extended to the wall of the centrifuge, with, it is said, the surprising result of adding 50 per cent. to the effectiveness of the separator. The old Laval separated sixty gallons an hour, the new Laval separates ninety gallons an hour, the power and speed required being the same in both cases.

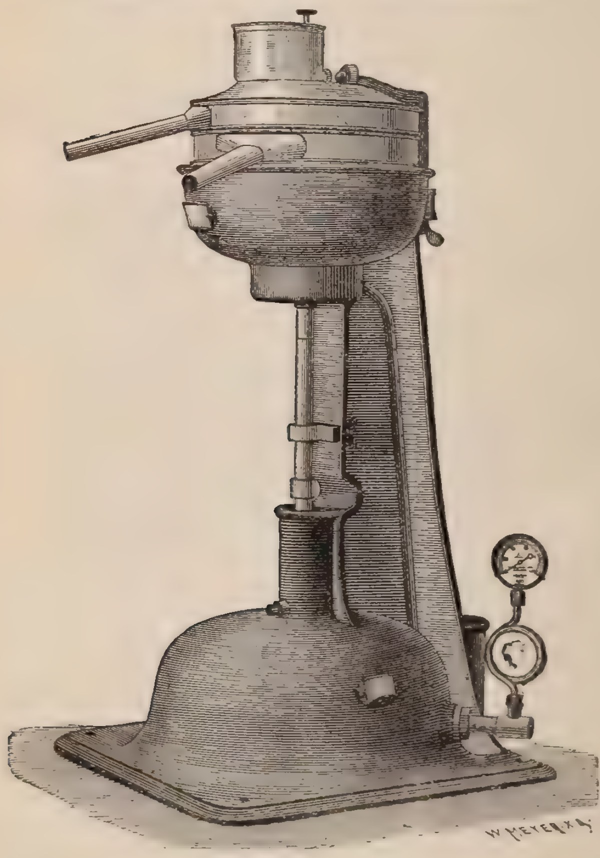
The Turbine Separator is illustrated by the woodcut on p. 208 (fig. 9), and consists of an ordinary Laval centrifuge, having its spindle fitted with a "Barker's Mill," forming a motor; the object being to render the separator independent of the steam engine.

The "Turbine," which is enclosed in the case forming the base of the machine, consists of a pair of S-shaped arms into which steam is led, and from whose extremities it issues just as water does from a "Barker's Mill," or steam from a "Hero's Engine." Conical rollers support the footstep

bearings of the machine, which, in all other respects than the above, is an ordinary Laval Separator.

As might have been expected, it was found on trial that the "Turbine" Separator is a greedy steam user, requiring a boiler-power of 2·82 horses, and this fact will, probably, militate against the general introduction of the new separator. There may, however, be cases where the consideration of power is a

Fig. 9.—*Laval's Turbine Cream Separator.*



minor factor in the sum, and where, therefore, the "Turbine" Laval may find a home.

Messrs. Penney and Company, Limited, of the City Iron Works, Lincoln, exhibited a new form of adjustable and self-cleaning Corn Screen (Art. 1539). At the Preston Show Messrs. Rainforth showed a very pretty means of constructing

adjustable and self-cleaning corn screens of the flat type, a plan which was tried and highly spoken of by the Judges at that show. Only two years later, Messrs. Penney and Company appear with an entirely different but, apparently, equally effective method of obtaining the same results, applicable whether to flat or rotary corn screens.

The screening wires are of rectangular section, and are laced on to cross rods by spiral springs, which not only hold the wires down but also tend to push them apart. The sides of the screen (or the ends if it be the cylindrical form) can be moved nearer together or farther apart by screws, and when this is done the wires accommodate themselves to the change, crowding together or spreading, as the case may be, the spaces between them being uniform over the entire riddle. In a shaking screen the spiral springs clear out, at each reciprocation, all the grain which has been caught between the bars.

The Anti-Friction Conveyor Company, of Mark Lane, London, exhibited a new "Conveyor" (Art. 2847) for moving grain, meal, &c., in any desired direction, whether vertical, horizontal, or otherwise. The woodcut (fig. 10) clearly illustrates this somewhat remarkable invention.

Screw conveyors for corn and meal have long been employed in mills, but the thread of the screw has always been of a disc-like character. In the present invention the place of this disc-like screw is taken by a mere spiral of wire, which is quite as efficient as its heavier and more expensive forerunner for the transport of grain and meal, whether through vertical, inclined, or horizontal

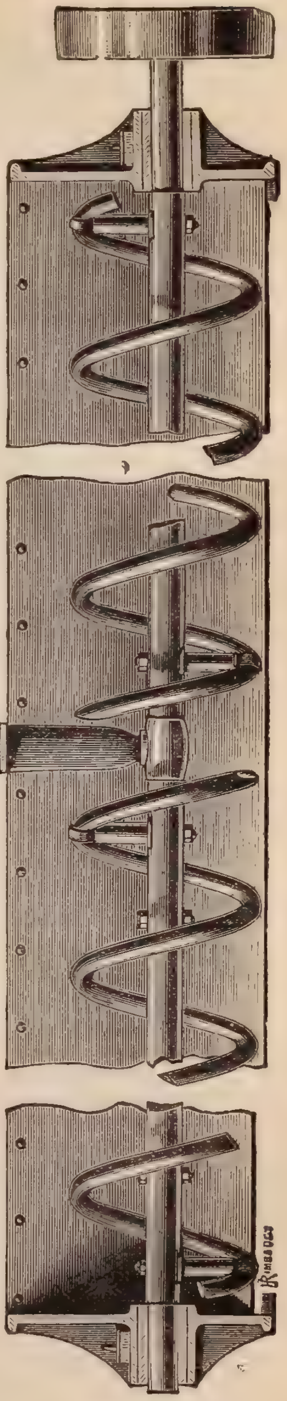


Fig. 10.—*The "Anti-Friction Conveyor," with Casing or Trough.*

shoots. The effect produced by this revolving spiral is really surprising. Setting only a small quantity of the mass contained in the trough in motion, it *persuades* the remainder to follow. This, no doubt, results from the fact that the impulsion is peripheral—in other words, that the material is urged forward just at, if only at, the point where it is in frictional contact with the trough. The quasi-homogeneous character of the mass itself does the rest.

Messrs. Hornsby and Sons, of Spittlegate Iron Works, Grantham, showed a new Double Furrow Plough (Art. 2,928), having an interest of its own, as illustrating the rapidity with which the long turn-furrow of the past is giving way to the short digging-breast that has always characterised American ploughs.

After many years of subservience to artificial ideas of what a furrow-slice ought to be like, plough-makers are gradually returning to the use of short digging-breasts, which, if they do not lay a brick-sectioned slice at a prescribed but arbitrary angle, at least break up the soil in a way very favourable to cropping. This return took effect, first, in simple ploughs, but is now spreading to double-furrow ploughs, whose construction is vastly simplified by the reform.

Robert Maynard, of Whittlesford, Cambridge, showed a chaff-cutter (Art. 2,956), cutting chaff and litter from $\frac{3}{8}$ in. to 6 in. in length.

Ordinary chaff-cutters experience a difficulty in cutting long lengths, because the arms upon which the knives are mounted pass in front of the chaff-box, and the issuing straw, unless the feed be moderately short, comes in contact with them.

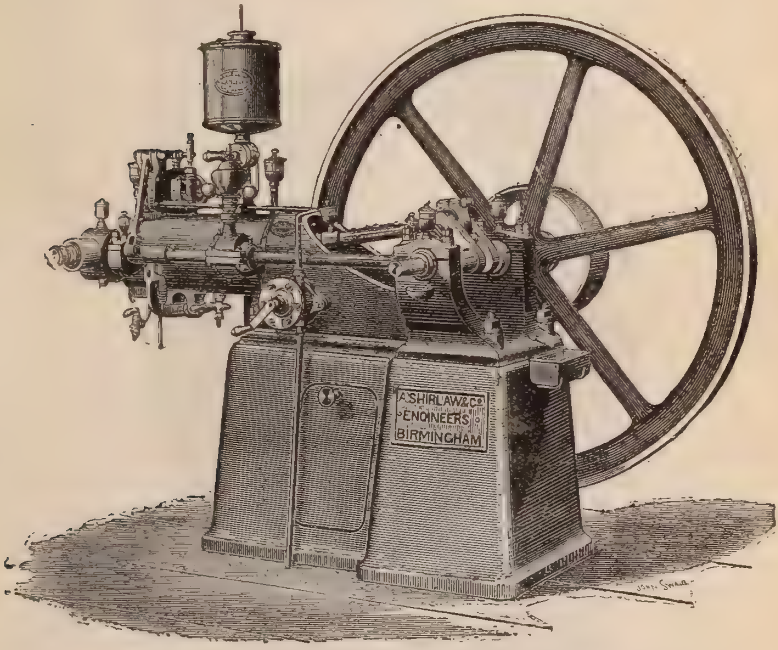
Maynard evades this difficulty by placing the axis of his wheel a little to one side of and high above the chaff-box, its periphery being entirely clear of the latter. The knives are attached peripherally to removable brackets, and, by using one or more knives, combined with suitable changes of the feed gear, any length of chaff and litter within the limits mentioned can be cut, the straw issuing from the chaff-box finding nothing to bar its egress.

Messrs. Shirlaw & Co., of Suffolk Works, Birmingham, showed, as a novelty, "Spiel's" petroleum engine (Art. 3,054), which merits description on the ground of its offering to the farmer who is unable to take advantage of that most convenient motor, the gas engine, a means of obtaining power without a steam engine, an advantage which the enormous sale of gas engines proves to be both great and general. It is unfortunate that the engine shown at Newcastle used petroleum of a volatile character, having a flashing point of too low a temperature to meet with the Judges' approval; but this fact, although properly de-

terring the officers of the Society from pronouncing upon the merits of Spiel's engine, must be taken for what it is worth by individual buyers, who, if cautious, need have no fear of accident in using benzoline (see fig. 11).

Spiel's petroleum engine is a German invention, only recently introduced into this country, where it is manufactured by the exhibitors. It depends for its action upon the explosion in the cylinder of a mixture of petroleum spray and air, just as

Fig. 11.—*Spiel's Petroleum Engine.*



a gas engine depends on the explosion of a mixture of coal gas and atmospheric air.

At the first, or "induction" stroke, the piston draws in behind it a supply of air through a suitable valve, which opens at the right moment for this purpose. At the same time, a small but definite quantity of petroleum is measured out from a reservoir by means of a plunger working in a barrel like that of a pump. At the end of the first stroke the air valve closes, and the oil plunger is lifted, ready to furnish a second supply. The air and oil, thus measured, enter the cylinder together, the former in a fine spray, a condition assumed under the action of the oil plunger, which, driving it forcibly against certain obstacles, breaks it up into the finest particles.

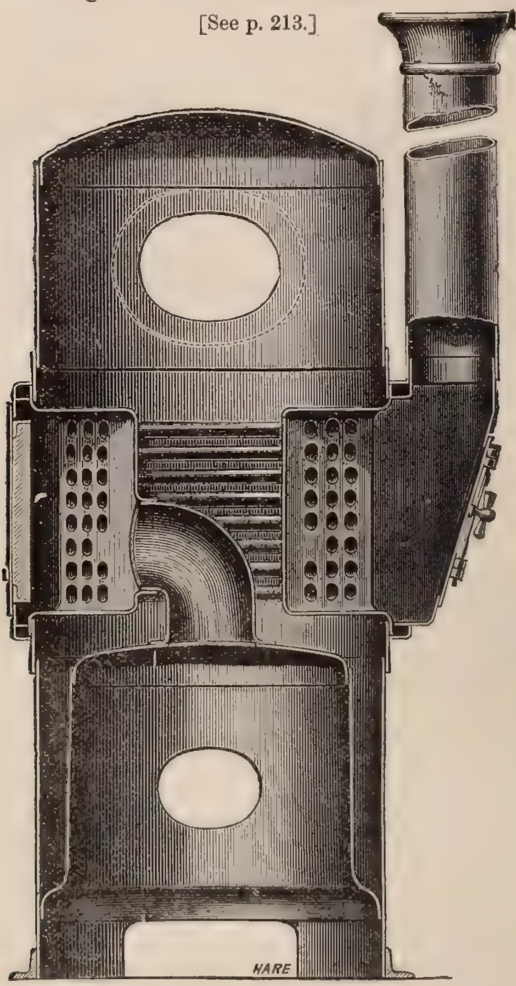
During the second, or "compression," stroke, the explosive mixture is compressed by the piston to about three atmospheres, and, at the end of this stroke, is exploded through a firing valve. The next is the "working stroke," at the end of which the exhaust opens, and the return of the

piston clears the cylinder of the products of combustion. The speed is governed, as in the Gas Engine, by cutting off the supply of oil when the engine is running too fast, and readmitting it when she falls below the proper number of revolutions.

An experimental test of Spiel's engine, made by Dr. Hopkinson, F.R.S., seems to demonstrate that, with oil at 7*d.* a

Fig. 12.—*The "Essex" Steam Boiler.*

[See p. 213.]



gallon, the cost of fuel would be about $1\frac{1}{2}$*d.* per horse-power per hour. This is somewhat more than the cost of fuel in a gas engine, but where small motors, doing intermittent duty, are

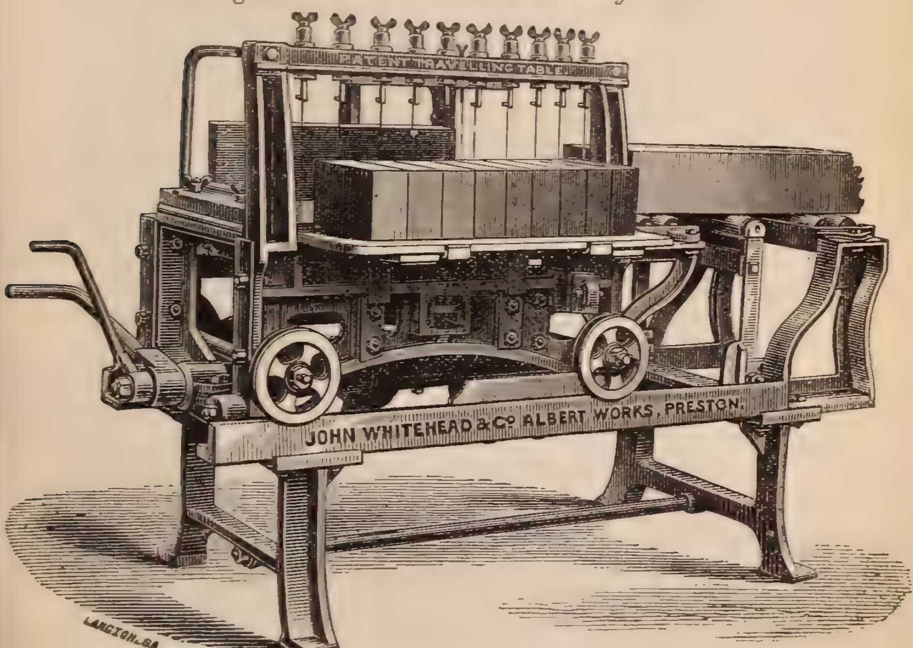
concerned, this is not a matter of much moment. These engines are made from ½ to 8-horse nominal horse power.

Messrs. Davey Paxman & Co., of Colchester, Essex, exhibited a vertical "Essex" steam boiler (Art. 3,123) of a somewhat novel construction, which is illustrated by fig. 12 on page 212.

A curved tube, riveted to the crown of the fire-box, conveys the products of combustion into a lateral chamber, of triangular section, having flanges by which it is secured to the boiler-shell, and furnished, exteriorly, with a door. An exactly similar chamber occupies the opposite side of the boiler, and has an exit into the chimney. These chambers are connected, one with the other, by means of curved horizontal tubes, having a radius somewhat greater than that of the boiler shell, so that they can be got into, or out of, position without removing either chamber. This arrangement, although involving somewhat complex forms in the tube chambers, which are shaped in a hydraulic press, gives great accessibility everywhere, and ready means of repairing when the tubes, or tube chambers, need overhauling.

Messrs. Whitehead & Co., Albert Works, Preston, Lancashire, showed a new brick-receiving table (Art. 3,127), with side

Fig. 13.—*Whitehead's Brick-Receiving Table.*



delivery cutting action, which is an ingenious and valuable addition to their brick-making plant (see fig. 13).

This table is mounted upon a short line of rails, and acts in the following manner;—

The stream of clay issuing from the die of the machine comes, eventually, against a vertical stop, placed at the front end of the table, thus pushing it along the rails; the clay and table then move at the same speed, and the stream of clay is divided square across by the single wire at the rear of the table into the length required to produce a certain number of bricks, usually nine, or more, according to thickness. This cut is effected from the front end of the table, by moving the small lever shown in the drawing. The attendant now pulls the table towards him, and cuts the separated block of clay into bricks in the usual manner, by side delivery action, which deposits them on the boards, upon which they are transferred to the barrow without being handled. The table is then pushed back, and the operation repeated.

The chief advantages obtained are: 1. A greater number of bricks are cut and delivered directly on to boards than by any other method at present in use. 2. The table is easily worked by one lad, and can be applied to any ordinary machine. 3. Waste is almost entirely avoided. 4. The labour and time hitherto employed and the mauling involved in pushing the block of clay by hand in front of the fixed cutting wires are entirely abolished.

Mr. William Johnson, of Castletown Foundry, Leeds, exhibited a well-designed and well-made pair of machines (Art. 3,140 and 3,141) for making and pressing bricks. Two methods of brick-making are in common use, viz. the wet, or plastic, and the dry process, of which the former may be looked upon as a modification, by means of machinery, of the old method of moulding bricks by hand; while the latter consists in reducing dry clay, or other suitable material, to powder, and pressing the finely divided earthy matter forcibly into moulds. Dry-process bricks require no drying, while wet-process bricks must be dried before going to the kiln—a fact which is economically in favour of the former method of production.

Mr. Johnson aims at making high-class bricks from clay which is neither wet nor dry, and which, while requiring no drying before being burnt, shall possess all the best qualities of wet-process bricks. With this end (not in itself new) in view, he feeds the clay, rather dry than wet, into a horizontal pug-mill, whose revolving blades, set spirally on the spindle, knead the materials into a stiffly plastic body.

The mouth of the pug-mill is closed by a horizontally revolving cylinder, whose periphery is recessed at intervals into brick-moulds. When one of these, in the course of the cylinder's revolution, comes opposite the mouth of the pug-mill, the spiral blades of the latter fill it forcibly with clay, which, becoming cut off from the general body of clay in the pug-mill itself by the continued revolution of the mould-cylinder, presently appears at a receiving table, upon which it is discharged by the action of a plunger, forming the bottom of the mould, and operated by a cam.

A boy receives the issuing bricks, which, at this stage of the process, have rough surfaces and broken edges, and passes them on to a table, whence an automatic intermittent feed delivers them, a brick at a time, to the brick press. The latter machine consists of a mould and two plungers, one of which presses,

while the other discharges, the finished bricks in excellent form, ready for the kiln. A second boy minds the brick presser, and a third feeds the clay into the pug-mill. The machine turned out bricks at the rate of 1,200 per hour.

Mr. Fawcett, of Burmantofts Foundry, Leeds, showed a dry process Brick-Making Machine (Art. 3,145), which consists of a clay-grinding mill, elevator, and brick-press combined.

The clay, or other material, is first finely ground under a pair of edge runners, and then elevated to a hopper, whose discharging mouth rests, with a pretty close fit, upon a reciprocating chamber, sliding back and forth upon a planed surface. The forward half of this chamber forms a box, open at top and bottom, while the rear half is closed at top and bottom.

When, in making its backward stroke, the open portion of the reciprocating chamber comes under the hopper, it receives a charge of clay, which is kept from escaping downwards by the surface plate upon which the chamber slides. On the forward stroke the charge is delivered into four brick moulds, and, meanwhile, the mouth of the hopper is closed by the rear, or closed, portion of the reciprocating chamber.

The brick moulds have each two plungers—one for pressing, the other for discharging the finished bricks; the former being operated by means of four toggle joints, connected by links, and operated from a single crank; while the latter are moved at the proper time by cams. The discharging plungers thrust the bricks up out of the moulds at the same moment that the reciprocating chamber is advancing with a fresh charge of clay, and the front wall of this chamber consequently pushes the finished bricks before it, while advancing to discharge its new load into the empty brick moulds. A table, attended by a boy, receives the finished bricks, which are delivered at the rate of 3,000 an hour.

The Working Dairy.

In view of the fact that the Working Dairy has been so often described in the pages of the 'Journal,' while a Guide to that at the Newcastle Show was printed by order of the Dairy Committee and sold on the ground, it is needless to give any detailed description of this always interesting and attractive feature of the Show. But it may be remarked that the Dairy, on this occasion, was designed to illustrate the English, French, and Danish methods of butter-making, as well as the making of the soft cheeses, called "Neufchâtel," or "Swiss Double Crême."

A practical examination of butter-makers was held at the dairy in the showyard on Thursday, July 7. Only four persons submitted themselves for examination, when the Judges

awarded the 1st prize and certificate to Mrs. Stevenson, the 2nd prize to Ernest Giles, and the 3rd prize to Mrs. Carr, Miss Margaret Hunter being commended. The small number of persons entering tends to show that the present system of awarding prizes requires alteration.

It should also be added that the implements used in the dairy are not specially recommended as the best. They were selected with a view of illustrating, as impartially as possible, the best systems in use. If space had permitted, it would have been easy to show more appliances, but difficult to operate them, because it is almost impossible to obtain a large supply of milk for a limited period in good condition at Show-time. The chief object kept in view in the selection of such vessels as were not exclusively dairy appliances was to illustrate the various ways in which labour may be saved.

With the exception of the "Jersey" Creamer (recommended, as stated elsewhere, for trial next year), the hand-power separator, and turbine separator of Laval, both described elsewhere, there was no new type of dairying implement exhibited. Fjord's centrifugal milk-tester has often been described, and M. Baquet's Delaiteuse was fully treated of in last year's 'Journal.'

The thanks of the Judges of Miscellaneous Implements are due, and are hereby tendered, to the Stewards and Engineers of the Society for the readiness and courtesy with which they responded to any and every request, whether for administrative or technical assistance.

X.—*Report on the Trials of Potato-raising Machines at Newcastle.*

By the late JOHN COLEMAN, The Mount, York.

[MR. COLEMAN'S death having occurred before the revision of his report for the printer, that duty devolved upon me, as one of his colleagues in judging the potato-raising machines. I take this opportunity of expressing my own personal regret, and the regret that must be felt by the members of the Royal Agricultural Society and the agricultural world, for his loss. Mr. Coleman has done much work for the Society, and he has done it well; his death leaves a blank that cannot easily be filled.—JAMES A. CAIRD.]

THE deferred trials of these important implements, for which the Royal Agricultural Society offered two prizes of 20*l.* each, took place on Tuesday, October 6, 1887, on the farm of Mr. Stephen Fairbairn at Gosforth, near Newcastle. Thanks to

the admirable arrangements carried out by Mr. Jacob Wilson and the stewards, everything was ready for work at the stated time, 10 A.M., and, aided by the weather, a rather formidable programme was got through with comparative ease by 5 P.M. The weather was favourable not only at the trial but for many days previously, resulting in a dryness and friable condition of the land, which facilitated working, and was more advantageous to the competitors than to intending purchasers, for whom a severer test, more in accordance with ordinary conditions, would have been desirable. As it was, all the machines in the first class made good work, and even the lower-priced implements got through the trials in a way that was better than we anticipated.

The Society were fortunate in securing a uniform crop of York Regents, at least so far as the amount of top was concerned. Here, again, competitors were in luck, inasmuch as the original luxuriance of the haulm was considerably reduced by the sharp frosts of the previous week, so that with one or two exceptions there was no difficulty in dealing with the crop in its natural state—a point of much importance, as the labour of removing the tops, which is necessary in some cases and for some kinds of implements, must be a considerable item. A flat of about six acres was divided by suitable headrigs into three equal portions of 100 yards long, and each containing eight drills for each machine, with one cleared drill between each plot. The two upper lots were left as they grew, the first being utilised for the preliminary runs, the second for the more exhaustive tests, whilst the third, from which the tops had been most carefully removed, was mainly useful for the draft trials by the dynamometer, and for any final test that might seem necessary. There were eleven machines entered for trial, seven in the first class, for which the conditions were that the cost should exceed 5*l*., and four in the second class, in which the price of the machines should not exceed 5*l*.

Most of the machines were very similar as to general design, differing slightly in details. Thus they comprised a strong cast-iron framework carried on the axle of two large travelling wheels, on the peripheries of which spuds are bolted, which prevent slipping and secure adequate driving power motion by means of ratchets on both wheels; and bevel gearing is communicated to a shaft, carrying, at its termination behind, a revolving fork furnished with eight arms, which are bifurcated at their ends. The diameter of the travelling wheels being usually about 4 feet, that of the fork 3 feet 6 inches, the respective speeds being about six to one, *i.e.*, for every 12 feet of advance, the fork-wheel makes six revolutions. This considerable speed is required to lift the tubers, and a large portion of the soil, a

proper distance from the row, and this is more especially the case when the soil is either of a close heavy nature or at all moist. Beneath the fork and attached to its shaft, is a broad triangular-shaped share. In most cases both share and fork are actuated by a leverage from the front wheel, the depth being regulated by a lever handle, fitting into a graduated bar or ratchet; but in some cases the depth of the share can be altered independently of the fork by a screw actuated by a wheel-handle. This is a decided advantage, as being much more expeditious and certain than lowering the arms of the share by loosening a wedge. Some of the machines had no front wheel, and were consequently less steady in action.

I proceed to a more detailed description of the machines that were noticed by the Judges.

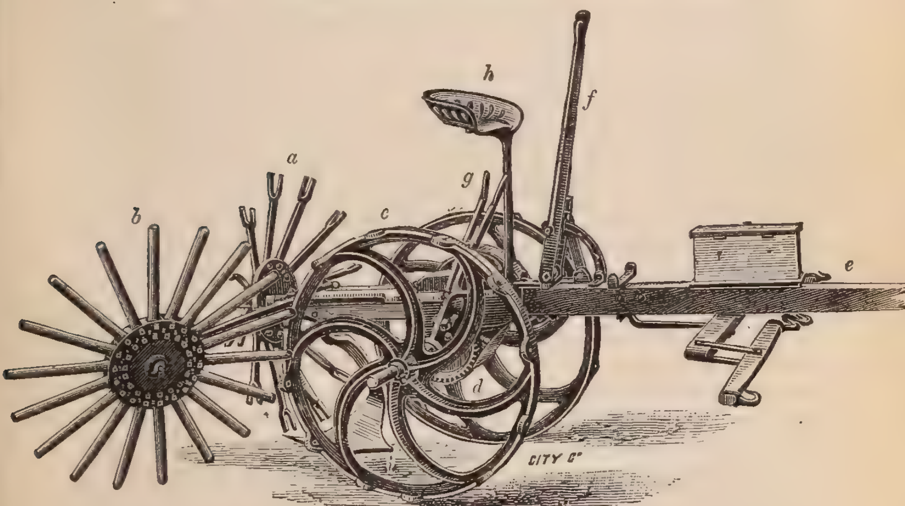
IMPLEMENTS THE PRICE OF WHICH EXCEEDED 5*l.*

No. in Catalogue	Name of Exhibitor	Address of Exhibitor	Price £ s. d.	Remarks
1667	Allan, J. D., & Sons	Culthill Implement Works, Dunkeld, N.B.	12 10 0	Commended
1766	Elder, William	Tweedmouth Implement Works, Berwick-on-Tweed	13 0 0	—
1557	Jack, Alexander, & Sons	Maybole, Ayrshire	13 0 0	—
1670	Kyd, Robert	Cupar Angus, Perthshire, N.B.	13 0 0	Reserved number
1540	Penney & Co., Lim.	City Iron Works, Lincoln	16 0 0	—
1835	Powell Bros., & Whitaker	Cambrian Iron Works, Wrexham	13 13 0	Prize of £20
1628	Thompson, Moorhouse A.	Old Tweed Implement Works, Berwick-on-Tweed	14 0 0	Highly commended

No. 1835. *Powell Brothers & Whitaker, Wrexham*, are the manufacturers of the prize machine, invented by Mr. J. A. Lewis, of Hassall, near Sandbach. The illustration opposite gives a good idea of it. Its principal features are that the fork wheel, instead of being cast in a straight form, is cone-shaped, with forks set on an angle, by which it is contended, and I think correctly, that the forks work more directly under the ridge, thus moving the tubers with less soil, and insuring more perfect work. Another important point is that the number of forks can be varied from 6 to 12 to suit the soil and crop; but as the fork wheel is speeded somewhat slower than most of the machines, it is generally desirable to employ the

larger number of forks, which was done at the trial. It is also capable of adjustment backwards or forwards, *i.e.* it can be brought closer to, or further from the back of the share, to suit heavy or light soil. Another novelty is the substitution of a revolving wheel or cratch, in place of the fixed screen usually adopted, as a means of collecting the potatoes in rows so as to facilitate packing and prevent burying. It is hung loose upon its axle, and caused to revolve by the force of the soil thrown against it. It was claimed for this arrangement that it arrested the tubers more completely and allowed the soil to pass through more effectually, but, owing to the angle at which it was, and

Fig. 14.—*Powell Brothers & Whitaker's Potato-Raiser.*



a, fork-wheel, showing angle at which tines are set; *b*, revolving cratch-wheel; *c*, position on rim of wheel for studs which are bolted underneath; *d*, bevel gearing; *e*, pole for draft; *f*, lever rod for lowering or raising fork-wheel and share; *g*, lever-handle for throwing in and out of gear; *h*, driver's seat; *i*, share.

which I think was unnecessarily acute, a considerable number of the potatoes passed beyond the screen. Moreover, the collection was not so perfect as it might have been. This was pointed out by the Judges, and I am glad to learn that the manufacturers fully realise the present imperfection of this portion of their machine, and have decided to make the position of the cratch adjustable, so that it can be worked at several angles.

I can quite imagine that a revolving-wheel would bruise the potatoes less than a fixed screen, but I do not believe that this or any other machine can dig one row after another and make economical work without the potatoes being first picked up.

Both driving-wheels are adjustable on the axle to suit the width of ridges, and are self-cleaning. The gearing is simple, strong, and well protected, the speed is gained by spur and bevel wheels. The machine is fitted with a pole, which insures steadiness and does away with the necessity for a fore-wheel. It is also provided with a seat for the driver, which is a distinct advantage, as, though the pace travelled is not fast, much unnecessary exertion is thus saved. Moreover, the driver has within easy reach the two levers which regulate the working parts of the machine. That on his left hand regulates the depth of the share, and allows of his lifting it clear of any obstruction, whilst a shorter handle on the right puts the machine in or out of gear.

The workmanship throughout is excellent, and the price reasonable. The exhibitors stated that the speed was as 4 to 1. The diameter of the driving-wheels was 37 inches, that of the fork 44 inches. In the first trials as to cleanness of work a considerable number of tubers were left—viz., in a distance of 20 yards, 7 in the first test and 18 in the second; but upon the share being lowered about half an inch, the work was much better, only two single potatoes being missed. To this machine the Judges awarded the prize in Class 6, and so entirely was the verdict of the public in accordance with the decision of the Judges that a number of orders were given prior to the award—one by Mr. Fairbairn, the tenant of the farm.

No. 1670. *Mr. R. Kyd's* machine was granted the reserve number, not on account of excellence of manufacture, but for the presence of a fore-carriage carrying two small wheels. This gave great steadiness to the machine, as was proved by the dynamometer trial, which might have been even better but for the exhibitor's lowering the depth in the middle of the run, a very superfluous proceeding on his part. Kyd's is a very light machine, the gearing protected by a rough cover of sheet iron. There is only one bevel wheel and pinion. One lever sets in gear and regulates depth. The fork wheel is 39 inches in diameter, the driving-wheels nearly 4 feet, and the revolutions $5\frac{1}{2}$ to 1. The frame is of wrought iron as well as the fork-wheel. All this might be of malleable cast metal with great advantage to the machine, and allow of a considerable reduction of cost. The work was highly creditable, and, if turned out in a more mercantile form, the machine should be both cheap and useful for light soils, and especially for undulating ground.

No. 1628. *Moorhouse A. Thompson.* This is an exceedingly well-made machine, well deserving its high commendation, and its work was excellent, whilst, as will be seen by reference to the table of draft, supplied by Mr. F. S. Courtney, of the firm of Easton & Anderson, the Society's consulting engineers, this

was the lightest of all. There is a very excellent arrangement for altering the depth of the share, independently of the revolving fork. The latter comprises 8 tines, but differs from the rest of the machines in having three prongs at the end of each tine, which may prevent the occasional bruising of the tubers, that must occur when, as occasionally happens, they become wedged between the prongs. There is, however, one defect in this machine, which might be easily remedied. The pauls on the wheels are not guarded, and would be likely to get clogged in moist soil. The peculiarity of this machine is that the "spuds" or projections on the rims of the wheels are cast with the wheels and extend right across their surface, a fact that no doubt facilitates operations in the field, but would render the machine incapable of being travelled on paved roadways, and is hence a doubtful advantage. Considering that this arrangement somewhat reduces the cost of manufacture, I am at a loss to understand why the price should be so high.

No. 1667. *J. D. Allan & Sons.* This machine was commended, principally on account of good work and light draft, as there was nothing specially meritorious in its construction. The gearing was fairly strong and well inclosed, and price reasonable. One lever in front regulates depth and puts in and out of gear. There is no mechanical arrangement for raising the share independently of the fork. The potatoes were considerably bruised, probably owing to a rather rapid revolution of the fork-wheel. The clearance was exceedingly good, on two trials only two potatoes in each case were found undisturbed.

Only one other machine requires brief notice, viz. No. 1540, shown by *Messrs. Penney & Co., Lincoln.* This, it will be seen by reference to the table at the end of the report, proved of exceptionally heavy draught. The manufacturers explained that it was intended for the strong warp soils of Lincolnshire, where a heavy machine was indispensable. It is needless to say that from such a firm excellent workmanship was a certainty, and in this respect the machine left nothing to be desired. In one respect, viz. that of the share, it was different from the rest. Messrs. Penney stated that they had discarded the ordinary form of share, which they found cut the potatoes too much, and this was a great improvement. It consists practically of an upright ploughshare fixed on the left side of the implement, with a cutting surface of 14 in. which is supposed to go under and thoroughly disturb the drill; but we found, unless held very hard into the row, it was apt to miss a number of tubers on the extreme right, and at the first no fewer than 24 were left in 20 yards. We should certainly much prefer to have one occasionally cut, to such inefficient work as this. The rake

appeared to travel rather fast, and there was a tendency to bury the tubers, which must add to the cost of collecting.

IMPLEMENTS COSTING NOT MORE THAN 5*l.*

No. in Catalogue	Name of Exhibitor	Address of Exhibitor	Price	Remarks
			£ s. d.	
1808	Cooke, John, & Sons	Lindum Plough Works, Lincoln	4 15 0	—
1767	Elder, William.	Berwick-on-Tweed	4 10 0	Reserved
1576	Gregory, John .	Westoe, South Shields	4 10 0	Prize of 20*l.*
1631	Lankester & Co.	44 Sumner Street, London, S.E.	2 10 0	—

Before describing these machines in detail, it may be stated generally that all comprise an ordinary plough frame, with a share which has either one or two wings, and some special arrangement of skeleton fingers in place of mould board. So that, in fact, any ordinary plough may be made equally efficient by simply substituting an open breast for the ordinary mould board; or, if it is preferred to split the drill and throw the potatoes on either side—which certainly has advantages, as rendering them less liable to be buried—we take the double mould board plough, and apply the open breast. Hence it does not appear desirable to encourage the introduction of a separate implement, and the utility of the prize would have been greater if it had been for the addition or substitution of parts in a common single or double mould board plough, which render it best adapted for raising potatoes.

No. 1576. *John Gregory's* machine consisted of an ordinary plough beam and frame carrying a broad double-winged share, with a pair of wheels in front, the double breasts being replaced by sets of open bars on each side, which allowed a good deal of the soil to fall through, leaving a larger proportion of the tubers exposed than any of the other machines. The best work was of course made where the haulm had been removed; indeed, implements of this sort are not capable of dealing with very luxuriant tops, as the latter are apt to clog between the bars and the under side of the beam; but, as there is a fair amount of space in this machine, it did quite as good work as could be expected.

No. 1767. *William Elder.* This implement resembles an ordinary ridging plough, with very long and straight boards, behind and below which are placed prongs projecting backwards. The idea is that as the soil and potatoes fall back from the end of the boards, they are received and separated on the prongs; but, as far as we could see, the work would have been as efficient

without this addition. Anyhow, it was decidedly the second best, and therefore reserved.

No. 1808. *John Cooke & Sons.* This implement, worked as a one-way plough, with the skeleton mould board on the right side, is capable, by the alteration of the share and the addition of mould boards on each side, of being converted into a ridging and earthing plough. Or it can be worked as a general purpose plough; or as a digging plough, being Cooke's No. 45 convertible plough. It is a thoroughly strong, well-made implement, and if all the various additions are included in the price, 4*l.* 15*s.*, it is a cheap implement, although, as a potato-raiser even in such favourable soil, the work was anything but efficient, the furrow being turned over almost unbroken, and a large portion of the crop was consequently buried.

Lastly, we have the implement No. 1631, exhibited by *Lankester & Co., of London*, manufactured by *Messrs. B. F. Avery & Sons, of Louisville, U.S.A.*, described as a steel wing potato-digger. It consists of a very short beam, with a broad double-winged share, and steel tines on either side, which are placed much too near the under side of the beam. It is without front wheels, and consequently difficult to keep straight; moreover, when dealing with the crop in its natural state, owing to the defects we have pointed out, it continually blocked and could not make good work at all. When worked on the haulmless crop, by dint of constant agitation of the stilts it did extremely well, and appeared to separate the tubers from the soil more perfectly than any of the others in the same class. Of course, a machine that can only be successfully used when the tops are removed is not qualified to take a prize. It has the merit of being very reasonable in price, viz. 2*l.* 10*s.*

Engineer's Report on Dynamometrical Tests at Potato-raising Trials at Newcastle.

Exhibitor	Catalogue No.	Mean draught in lbs.
Penney & Co., Lim.	1540	576 [1]
A. Jack & Sons	1557	383 [2]
J. D. Allan & Sons	1667	363 [3]
Robert Kyd	1670	377 [4]
William Elder	1766	425 [5]
Powell Bros. & Whitaker	1835	366 [6]
Moorhouse A. Thompson	1628	372

Remarks on Individual Exhibits.—[1] Two runs gave each a mean pull of 515 lbs. and 536 lbs.; in these the machine was not set sufficiently deep to clear all the potatoes. A third run, with machine set deeper, gave 679 lbs. mean pull.

[2] The first run gave a mean pull of 431 lbs., the last two a mean of 369 and 348 lbs.

[3] Two runs with this machine gave very uniform mean draught.

[4] The range of draught in each run was very limited in this machine, two runs of same depth giving mean draught 361 and 364 lbs. each, a third run, set deeper = 408 lbs.

[5] Two uniform runs.

[6] Owing to this machine having a pole there was a little difficulty in fixing the testing machine. Extra length of pole had to be fitted.

General Remarks.—There is nothing that calls for special engineering comment in these trials, beyond the statement that in every case the mean draught of each run was very similar, which tends to prove the correctness of the record.

Possibly Powell & Whitaker's draught may be a little excessive. That machine was fitted with a pole, and, to fix the dynamometer underneath it, it was necessary to prolong the pole. To keep the prolonged end of this pole below the horses' collars somewhat depressed the machine and may have added to the draught, owing to the share passing through the ground at an angle other than that at which it was set.

Kyd's machine was not worked to the best advantage by the exhibitor; there was less oscillation of draught in this machine than in any of the others. This was owing to the play allowed by the fore carriage.

Thompson does not come out so well on the dynamometer as his position in the award should warrant; a very trifling difference of depth, however, makes a very appreciable difference in the draught. In this trial the machine was set so as to turn the potatoes well up, and this no doubt accounts for the draught appearing somewhat high.

(Signed) F. S. Courtney.

XI.—*Report on the Farm Prize Competition in Northumberland and Durham in* 1887; *Classes* 4 *and* 5. By Thomas Rigby, Sutton Weaver, Cheshire.

Judges.

William Priday, Linton, Gloucester.
Frederick Punchard, Underley Estate Office, Kirkby Lonsdale.
Thomas Rigby, Sutton Weaver, Cheshire.

The reporting Judge in Classes 1, 2, and 3 has described at length, in the last number of the 'Journal,' the farms which he and his colleagues inspected, and has given an elaborate and lucid account of the chief features of the Farming and kindred characteristics of the two Counties. The Judges of Classes 4 and 5 are therefore relieved from making the usual explanatory or introductory remarks to the Farm Reports, and only propose to report as briefly as possible on the management of the Farms that came under their own inspection.

In Class 4 there were six competitors for the two Prizes of 50*l.* and 25*l.* offered for the "Best and Second-best Managed Dairy Farm of 75 acres and upwards, where the management and cultivation are most successfully directed to the production of milk, butter, or cheese."

In Class 5 there were four competitors for the two Prizes of 50*l*. and 25*l*. offered for the "Best-managed Arable and Grass Farm of 100 acres and upwards, occupied and carried on in conjunction with a Colliery."

The Judges commenced their first inspection on Tuesday, December 14, 1886, and finished it on Saturday, the 18th, one of the coldest days of the winter. Their second inspection began May 17, 1887, and ended May 26. All the farms had a full day given them on this inspection, except two of the smallest, which were taken on the first day. On the third visit two farms in Class 4 and one in Class 5 were not visited, but all the others and one of those entered in Class 1 (the winning farm in the champion class) were carefully inspected, beginning July 4. The awards were all decided upon on July 8, were made known at Newcastle during the Show, and were reported in the last 'Journal.'

Class 4.

The competitors in Class 4 all resided within a few miles of Newcastle, and the list on page 226 shows their names and addresses, and certain features of their holdings, in a tabular form.

It will be seen from this Table that the competing farms varied in character in almost all the points mentioned. But the differences did not end there. The proportions of the arable and pasture lands differed greatly. One farm grew a large quantity of corn; another had more than half its area in pasture; a third had only a sixth in grass; whilst a fourth had but an eighth. Again, on the farms near to Newcastle, the growth of hay, green fodder, and root crops for sale in that town made their cultivation almost as important an object to their tenants as the production of milk; whilst on the two others farther away the rearing and grazing of stock for feeding or for other purposes than dairying had no inconsiderable bearing on the system of cultivation and management followed. But the greatest difference (and one which forced itself most on the minds of the Judges) lay in the extent to which the production of milk was made the leading feature. Milk only is mentioned because, although the farms were entered as "Dairy Farms producing Milk, Butter, or Cheese," the first-named commodity was almost the only dairy production, butter and cheese being seldom made, and only when the supply of milk exceeded the demand for its wholesale or retail distribution. As a consequence of this, the production of milk followed chiefly the difference in number of milking cows kept in proportion to the extent of the farm. Thus, on one farm the cows kept were as one to three acres; on two others as one to six acres; on a fourth as one to

List of Farms entered in Class 4.

Competitor	Area	Tenure	Occupied	Soil	Subsoil	Rotation	Manure used	Farm buildings	Position in competition
Stephen Fairbairn, South Gosforth, Newcastle	acres r. p. 583 3 12 in 3 farms	$\frac{2}{3}$ leasehold $\frac{1}{3}$ annual agreement	8 years 4 years 1 year	Loamy, strong	Part strong clay, part sand	Four course system	Farmyard, bones, salt, &c.	All fairly good and well kept	Second prize
John Reay, East Brunton, Newcastle	315 0 0	Yearly tenure	8 years	Medium soil	Clay	No fixed course	Farmyard, guano and lime	Good substantial	First prize
William Trotter, South Acomb, Tyneside	187 0 5	Annual agreement	13 years	Part sandy, part good, friable soil	Poor clay, gritty stone	Six course system	Farmyard, sulphate, phosphates and kainit	Average character and condition	Commended
Charles Marshall, Broomhaugh, Tyneside	83 0 0	Lease for 12 years	3 years	Light, sandy	Gravelly	Six course system	Farmyard, bones, kainit, gas and lime	Good and suitable	—
James Thomson, Wylam, Whitchester	407 0 0	Leasehold, 14 years	4 years	Medium soil	Chiefly clay, a little gravel	Four course system	Farmyard, bones, nitrate and lime	Medium suitable	Highly Commended
Joseph Lambert, Whickham	81 2 2	Yearly tenure	4 years	Medium	Sandy, free clay	Four course system	Farmyard, gas and lime	Limited, fairly good	—

eight; on a fifth as one to eleven; and on a sixth as one to thirteen acres. It was, therefore, soon evident to the Judges that they had to compare farms which differed greatly in stocking and management, and that in judging the farms as "Dairy Farms having their management and cultivation the most successfully directed to the production of Milk, Butter, or Cheese," they would have to treat as secondary matters items to which, if they had been judging the farms simply as arable farms, they would have had to attach considerable importance.

Mr. Stephen Fairbairn's holding, situate $2\frac{1}{2}$ miles north of Newcastle, consists of three farms—"South Gosforth," 236 acres; "Three-mile Bridge," a farm of 125 acres, adjoining it on the north side; and "Gosforth Moor House Farm," $222\frac{1}{2}$ acres, also adjoining it on the north. The high road from Newcastle to Morpeth lies along the west side of the whole holding for more than a mile, and an occupation road lies between it and the adjoining estate, almost parallel to it on the east side. The land is divided into nearly equal-sized fields, having good gates and fences and a considerable length of more occupation roads in good order, many yards being newly made and well done. "South Gosforth Farm" is the milk farm of the three. On it the tenant resides in a good and comfortable house, and from it the dairy of milk is served. The buildings are substantial, convenient, and in good keeping, with a well-filled stackyard adjoining. A colliery is worked on the east side of this farm, and a tramway for its use crosses the holding here. "Three-mile Bridge" and "Moorhouse" farms have several small plantations of trees upon them, but they lie compactly together, and have commodious homesteads and good stocks of cattle, horses, and sheep. A large part of their area is pastured and mowed for hay. The green crops on the whole occupation were 57 acres of turnips, $32\frac{1}{2}$ potatoes, and 14 cabbage, tares and grass, all looking remarkably well and being under forward and good cultivation. The corn crops were 67 acres wheat, 97 oats, $8\frac{1}{2}$ barley, and $11\frac{1}{2}$ beans. The hay crop covered 220 acres, and 78 acres were in pasture. Twenty farm horses and four breeding mares were kept, and the whole place was under efficient management.

Mr. John Reay's farm, East Brunton, is separated from Gosforth Moor Farm only by the Morpeth high-road, alongside which it lay for nearly half a mile in form of a parallelogram. It is crossed in the middle by a road that passes the homestead near the centre of the land, and the fields all lie conveniently near. The house and buildings are substantial stone erections, covering a large space, and have an imposing appearance. The buildings had been erected for a stock and corn-growing farm,

but three of the feeding sheds had been altered and adapted for tying up milking cows. The land was chiefly in grass—50 acres old pasture, 116 acres newly laid down grasses, and 67 acres meadow grass; of the arable land 16 acres only were in turnips and 6 in tares, 30 wheat, 22 oats, and 6 barley. The gates were all newly painted, the hedges (a limited length) were newly trimmed, and the fences—much of which were wood posts and wire—had all been newly repaired or lately erected. The occupation roads were in good keeping. The land lay well to view from the approach to the farm. The stackyard, filled with the previous year's crops, was a grand sight on our first visit, and the large wheat and hay crops on our last visit were equally imposing. A large quantity of manure is carted from Newcastle, and upwards of 100 loads of gas-lime are used annually. Ten farm horses and colts, two milk ponies, and two young harness horses in the breaker's hands, were the whole of the stock kept besides the cows, of which more hereafter.

Mr. William Trotter's farm, South Acomb, is 13 miles west from Newcastle, 325 feet above sea level, and is gained by a steep road that crosses the farm, and leaves the land lying right and left of it with a pleasing appearance, and mostly to the noonday sun. It is divided into ten fields, of average size, having good gates to enter, and remarkably well-kept hedges. Forty acres of it lie detached and lower than this part, with a large fir plantation intervening. There are 83 acres in pasture, 64 to be mowed for hay, 14 turnips and green crops, and 25 acres in oats and barley. The soil on half the farm is fairly fertile, lying on a subsoil of millstone grit; the remainder is a poor thin soil, on weak clay. The herbage of the pastures is fresh-looking but short, and is kept short by heavy stocking. The land recently laid down is composed of well-selected grasses, and the pasture promises to come out well as it gathers age. The stock of the farm consisted of 28 milking cows, 16 heifers, 8 calves, and 100 ewes and lambs. Besides these there were something like 20 cart stallions, breeding mares and young horses, the property of Mr. Trotter, jun., which were kept on the farm, but fed largely on purchased food. These animals, being well fed, greatly improve the manure heap, and the whole farm had the appearance of being well fed like the horses.

Mr. Charles Marshall's farm, of Broomhaugh, lies in the valley of the Tyne, and about two miles lower down the river; about half the farm is in grass, the other half arable. The cultivation and cropping of the arable portion was well done. The pasture land had good herbage, was free from noxious weeds, and was in good heart. The soil and subsoil were gravelly and light—a hot dry soil would be an apt description. "It burns without

provocation," said the tenant; adding, "In hot weather we are afraid to light a pipe on it." There were 22 acres of oats and barley, 11 of turnips, 37 of mowing and 8½ in pasture, 2 active compact farm horses and 25 milking cows.

Mr. James Thomson's farm, Whitchester, lay across the country, 9 miles distant from Newcastle, on the line of the old Roman road, which pursues its ancient course straight on very distinctly for 20 miles further. This farm is 400 feet above sea level, and has all kinds of soil and subsoil upon it, and nearly every possible aspect and condition. It was taken on lease for 14 years four years ago, in a very rough state, by the present tenant, and has been greatly improved in many ways since then. But though much has been done, much still requires doing. The landlord has contributed to many permanent improvements, and the tenant has made a large outlay upon the farm in draining and in arrangements to economise labour. It argues the possession of rare enterprise, sound judgment, and great industry in both Mr. and Mrs. Thomson, to see them trying to make their outlay and cultivation pay, as well as promise to pay. They were growing 34 acres of turnips, 66 of corn, and 50 of clover. They had 255 acres in pasture, and keep 8 horses, 56 store cattle, 100 breeding ewes and their lambs, besides 38 milch cows. All the work of the farm is done in a practical manner.

Mr. Joseph Lambert's farm, Whickham, is the least in extent of the six. It is situated 4 miles west of Newcastle, and is a fine example of what family co-operation can do in making a small farm profitable. It has only 11 milch cows on it, but upwards of 100*l*. is expended annually in cake and feeding stuffs for them; 400 loads of manure and 60 of gas lime are put upon the land; about 10 acres are put into potatoes and turnips, 22 corn, and 28 hay. The soil is fairly good, but lies on an open stony subsoil. Its situation and the roads to it do not facilitate its management, but the farm wears an improving look and challenges complaint. The tenant richly deserves a better farm.

Management of Cattle and of Milk by Competitors.

Mr. Stephen Fairbairn had his milking cows standing in single row in two byres, 20 in one and 15 in the other. They were nearly all well-bred Shorthorns of a good milking type. About a third of them had been reared on the place, the others were purchased as calving cows. The practice was to feed all well, rear calves from the best milkers for future stock, milk the others as long as they give a fair quantity, and then sell as beef. The cows were kept very clean, and their byres were swept and rinsed daily with water. They had hay given them twice a day,

turnips three times, and of barley, wheat, and pea-meal ground together, they had 4 lbs. per day each, mixed in two feeds of brewers' grains. The milkers are women, and are paid 3*s.* per week. They begin their work at an early hour both morning and afternoon. The milk is all passed through a refrigerator together, and then sold by retail in the suburbs of Newcastle at 4*d.* per quart, two men taking it round in carts. From 45 to 55 gallons are thus distributed daily. Mr. Fairbairn had conducted the business in this way for eight years, and there had been a milk trade done from the place for fifty years. He had, at the time of inspection, 150 customers on his books.

Mr. Reay's cows stood in five sheds in single lines, arranged with much uniformity as to size and colour. They were all fine, well-bred dairy cows of the Shorthorn type, 53 in number, and, when seen on May 19, 48 were giving milk. In one byre were 13 white or light-coloured cows: all with large udders. In another shed were 10 roans or strawberry-coloured, all very fine beasts. In the next were 10 blood-reds, all very good; in the next 9 roans and 1 black cow, and in the next 8 roans and 2 red cows, all large beasts and in good condition. The plan pursued here was to purchase only very fine cows recently calved, or near calving, feed them well, but keep the bull from them, and sell again to be killed as soon as the natural flow of milk abated and came to be small. Some were kept only six months, but others kept their place in the herd nearly two years, the average being nine or ten months. Seven fat cows had been sold since our first visit, and an increased number of fresh calved cows of superior quality purchased to fill their places and to provide more milk to supply a recently made contract with the caterer of the Newcastle Exhibition. The cattle were a fine sight when all were turned out of the byres and put together into an early pasture as we were leaving. There was the same number of cows on our final visit, but a few were not doing well, and the sales made had not been replaced with quite so good-looking stock. They were still all well fed. Hay and turnips were supplemented with pea-meal or maize-meal or other cereal food of good quality, served with brewers' grains, and with cut chaff steamed, and seasoned with sugar or molasses.

The practice was to watch the market and to purchase that food which was best and cheapest. Newcastle seems to offer favourable opportunities for this. In July Mr. Reay was using carrots, purchased at 20*s.* per ton from the quays, good and sound, and wishing for more, or for anything as likely that might turn up and be as good. His contract price for milk was 1*s.* per gallon for the year round, delivered wholesale in Newcastle twice a day. The milk was all passed through a refrige-

rator, and mixed together carefully before being sent away. The milk-house and premises and the cans used were all scrupulously clean.

Mr. Trotter's cows were nearly all pedigree or grade Shorthorns. Most of them had been bred on the place, and one or two families had held long possession. They were 41 in number —28 cows and 13 heifers. The milking cows were fed upon mixed foods, and kept in clean condition in a double-row byre having a vessel-house at the end, in which the milk was refrigerated and prepared for market. All the cans and vessels were dealt with in a very efficient manner. Six pounds of barley, or 3 lbs. of barley and 3 lbs. of maize-meal, per cow, was the usual allowance of corn, besides hay and turnips, at our first visit, and 7½ lbs. barley, 21 lbs. hay, and 42 lbs. turnips were the daily rations later on. The most satisfactory and economical mixture that Mr. Trotter had found out was made of—

	£	s.	d.	
2 tons of coarse barley, at	3	5	0	per ton.
1 ton of best barley-meal, at	5	10	0	,,
1 ton of wheat sharps, at	4	10	0	,,
1 ton of oat-meal dust, at	1	10	0	,,

The cost of this mixture was 5½*d.* per 14 lbs., or 3*l.* 13*s.* 4*d.* per ton. Cotton-cake is not used at all now. Cows were often lost from milk fever when it was used, but since it had been given up Mr. Trotter said he had not lost any from this cause.

The yield of 25 cows from November 1, 1886, to May 1, 1887, had been 7,500 gallons milk, which was sold at 10*d.* per gallon. The previous summer half-year it had been 8,000 gallons, and then it was sold at 9*d.* delivered at the station. From these prices ½*d.* per gallon had to be paid for freight to Newcastle, 13 miles.

Mr. Trotter, who has quite a mechanical genius, has made a dial-plate weighing-machine for weighing the milk of each cow, and recording it in lbs. and tenths of lbs. As soon as drawn, it is hung on the machine in the can, and its weight at once written opposite the cow's name or number in the stock-book.

A summary of the weights thus kept of the milk from 28 cows taken during the year 1886, with periods of calving, date of purchase or if bred on the farm, and age, was handed to the Judges, and from it the following interesting particulars are taken:—

The *average* weight of milk given per cow during the year was 6471·6 lbs.; 10 of the 28 were first calf heifers. The *heaviest* weight, 10359·8, was given by a cow bred on the farm—half Ayrshire, calved March 13. The next heaviest was given by a purchased cow, a 'Cross'—calved March 11 —8653·0 lbs. The next by a grade Shorthorn, bred on farm, calved March 28

—8484·9 lbs. The heaviest weight given by a pedigree Shorthorn was 7759·6, calved July 24. The average of 6 pedigree Shorthorns for the year was 6349·4. The average of 10 grade Shorthorns, 6334·2 lbs.

Mr. Charles Marshall had also kept a full account of the produce of his cows. From May 1885 to May 1886 he recorded the doings of 12 cows to be an average of 764 gallons each, or a total of 9,171 gallons. One of them, "Primrose," had given 1,107 gallons in 13 months, from calving November 1, 1885, to November 30, 1886, and her milk had realised 41*l.* 5*s.* in that time. The summary of his milk sales from 22 cows for six months, from April 1 to October 1, 1886, was 8,261 gallons 3 quarts, for which he had received 306*l.* 12*s.* 6*d.* They were all well-bred, useful dairy cows. These weights may be more readily compared with those in the statement given by Mr. Trotter, if a gallon of milk be taken as 10 lbs. weight.

The milk was sent into Newcastle by train in a number of cans of various sizes to three customers at 9*d.* per gallon in summer, and by them fetched from the station and delivered to consumers. The freight was ½*d.* per gallon. The corn-feed consisted of barley boiled, or barley ground, of own growing and grinding, and of purchased bean-meal, maize-meal, bran and cake, and about 6 lbs. per day given to each cow (two-thirds being barley). Hay was given three times daily, and pulped turnips with chaff twice. The byres, pulping-house, and stack-yard were all arranged very conveniently for feeding. The milk was dealt with very economically in the matter of labour, and the milk-house was in perfect keeping.

Mr. James Thomson had 35 milking cows on our first inspection in December, giving 12 quarts per day each on an average, and on our second visit (May 20) he had 38, and was sending 120 gallons of milk away daily. They were young and useful cows—cross-bred Shorthorns—and had large square well-shaped udders. The milking hours were 3.30 in the morning and 1.30 in the afternoon, in order to catch trains running into Newcastle to serve customers. The cows were kept tied up in the shippon, and only allowed to go out for about two hours after the afternoon's milking. Their feed was barley, pea, or maize-meal, malt combings, cotton-cake, and bran given in scalded chaff; and turnips once a day—hay four times. Mr. Thomson had to cart his milk nearly three miles to a station, and to pay ½*d.* per gallon freight afterwards; but he understood the work both of milk-production and of its disposal, as he had been in the trade, and was building up a large and increasing business.

Mr. Lambert had a noted cow in his small herd whose doings deserve to be reported. She was a big white cow called "Beauty," was bred in Westmorland, and was 13 years old. She had not

been dry for 9 years, but had milked continuously and given as much as 36 and 38 quarts of milk daily, keeping to this quantity for four months after calving, and never going below 9 or 10 quarts per day. She had had a calf every year for 7 years, but only one in the last 18 months. She was now nearly blind, but in good health. Mr. Lambert gave 32*l.* for her when 4 years old, at Kirkby Stephen fair. She was a great feeder, and would eat nearly as much as two cows. Mr. Lambert sent his milk into Gateshead, sold it by retail at 4*d.* per quart, and at 3*d.* in quantity. His milk realised about 35*l.* per month. He and his wife had their hearts in their farm and in its success. They fed their cows liberally, cared for them almost as for their children, and spared neither thought, labour, nor outlay to make them profitable. "Beauty" always got a double portion at Mrs. Lambert's hands, and was milked three times daily.

The Judges, on their first inspection, conceived the idea of having the milk of the several stocks of cows subjected to a chemical analysis, thinking it might confirm or correct the generally accepted idea of the feeding value of different kinds of food, and also give some indication of the value of the hay or the pasturage of each farm. Having obtained the consent of the Council of the Society, and the obliging co-operation of Dr. Voelcker, their Consulting Chemist, the Judges sent him samples of milk taken by them on their second visit from the bulk of the milk at each farmhouse, as it was being sent away for sale. Six samples were thus sent, and an extra one from the milk of the Westmorland cow "Beauty," at Mr. Lambert's, making seven samples in all. The results of the analysis of each sample are thus stated by Dr. Voelcker:—

Constituents	Mr. Marshall's, Broomhaugh. 25 cows	Mr. Trotter's, South Acomb. 25 cows	Mr. Fairbairn's, South Gosforth. 35 cows	Mr. Lambert's, Whickham. 11 cows	Mr. Lambert's cow "Beauty"	Mr. Reay's, East Brunton. 48 cows	Mr. Thomson's, Whitchester. 38 cows
Water	87·11	86·38	86·71	87·04	88·56	86·51	86·73
Fat	3·87	4·58	4·37	3·85	3·00	4·53	4·29
Casein, milk-sugar, &c.	8·21	8·33	8·16	8·41	7·70	8·25	8·24
Mineral matter (ash)	0·81	0·71	0·76	0·70	0·74	0·71	0·74
	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Specific gravity at 60° F.	1·0326	1·0310	1·0318	1·0322	1·0304	1·0314	1·0321
Total solids . .	12·89	13·62	13·29	12·96	11·44	13·49	13·27
Solids not fat .	9·02	9·04	8·92	9·11	8·44	8·96	8·98

Remarks.—"The milks, with one exception (that of the cow 'Beauty'), came out very high indeed. As instances of the good quality of milk which can be obtained in winter-feeding of cows, the results are most satisfactory, and, with the exception of 'Beauty,' are much above the present limits fixed under the Sale of Food and Drugs Act, viz. 3 per cent. of fat and 8½ per cent. of solids-not-fat. Comparing the different analyses, there is practically nothing to choose between Trotter's, Fairbairn's, Reay's, and Thomson's.

"Marshall's and Lambert's are lower in quality than the other four, but they are both of really excellent quality, and well above the limits. The milk of 'Beauty' is far inferior to any of the others in quality, but it could hardly be expected that such enormous quantities could be produced of quality equal to the others. (Signed) "J. AUGUSTUS VOELCKER."

"May 28, 1887."

Several interesting questions might be discussed as to these yields: but I cannot here attempt comparisons on the various points which arise. It must suffice to say that the Judges, keeping in mind the terms on which the prizes were offered, carefully considered, in accordance with their instructions, the general management, the crops, the quality and suitability of stock; the management of grass land, the state of fences, roads, and general neatness; and the management of the milk and dairy. They awarded the prizes in accord with the weight of evidence and impression on these points as a whole. They are free to say they had most difficulty in fixing the places of the two first named. Mr. Fairbairn's crops were more extensive and his management of superior order on the whole; but Mr. Reay's cows, and his management of them in the production of milk, stood higher than the others, while his farming was also superior, and the Judges unanimously gave the first prize to him.

CLASS 5.

This class was for farms occupied and carried on in conjunction with a colliery, and it was soon apparent that farming for its own sake, or to make profit, was not the chief business of the competitors. It was rather to escape claims for damage to the surface by its sinking through the getting of coal from under it, or to reduce the charges upon the business of colliery proprietors, that the land was worked by them either as owners or as tenants; and the able and enterprising way in which it was done no doubt accomplished the desired result in the most satisfactory manner, while it left them free to act without those frequent references to the rights of each party and to arbitrations to assess damages which are always sources of annoyance to both parties.

The competitors in Class 5 were—

1. Messrs. Strakers & Love, Brancepeth Colliery, Willington, Durham.

2. The Seaton Delaval Coal Company, Seaton Delaval Colliery, Northumberland.
3. The Cramlington Coal Company, Cramlington, Northumberland.
4. The Earl of Durham, Lambton Castle, Fence Houses, Durham.

The occupation of *Messrs. Strakers & Love* consisted of four holdings, two of which were their own freehold property—The Burn Farm, 202 acres, 1 rood, 17 perches, and the Rough Lea Farm, 144 acres, 3 roods, 27 perches. The other two were the property of Lord Boyne—Oakenshaw, 164 acres, 3 roods, 3 perches, and Brandon Farm, 75 acres, 38 perches—and of these they were yearly tenants. Total—587 acres, 1 rood, 5 perches.

The nature of the soil on all the farms was of medium character, the subsoil being boulder-clay. There were good, substantial buildings on the first-named holding, suitable for feeding beasts and for breeding mares. There was a fine hay-shed, 50 yards long by 20 feet wide, with a slated roof fixed on larch poles, 13 on each side, and 20 feet high. The floor was laid with 3-inch planks, 2 inches asunder. There was also a shed for lambing ewes, containing 30 pens, convertible into loose boxes and shippons; this was 60 feet long by 15 feet wide. An implement-house, a turnip-house, a hen-house, and a large collection of poultry were notable.

The grass lands near the house were fairly good, but wet in places through the sinking of the surface, caused by getting coal from under it. The clover and grass seeds for mowing were full average crops; part of them were cut green, for consumption by the horses and ponies used in the collieries under the land. The oat and turnip crops were of average quality, as were the meadows mowed for hay. No wheat was grown.

The Rough Lea Farm adjoining had been lately purchased in a poor, rough state, and was being improved. Since obtaining possession, a year ago, the firm had drained about 100 acres, applied 240 tons of gas lime to corn and turnip crops, had eradicated 800 yards of old hedges, cut down much useless timber, and were fixing wire fences to divide all the land into fields of uniform size.

Oakenshaw Farm had been held for 21 years; the soil was lighter, and was cultivated under the 4 and 5 years' rotation of cropping—about 60 acres had been drained. This farm lay in an exposed situation, and was 650 feet above sea-level. Both the grass land and the crops were poor, and the surface generally was much affected by sinking. The coals in this district lie near the surface, are of a soft nature, not suitable for house

purposes, and are largely made into coke in kilns or ovens adjoining the land. Much harm is done to all the vegetation around by the smoke of these ovens.

Brandon Farm is held certainly more because of the coal under it than for the crops that may be got on its surface. The buildings were substantial erections; but very little can be said for the crops or the stock. All the manure made on the farm—80 tons—and about 20*l.* worth purchased, was applied to the grass seeds and turnip crops, but no artificial manure or lime had been used for the last 4 years. A large open ditch had been covered in at a cost of 50*l.*, and the average expenditure in cake was but small.

The management of all these farms was as good as was possible in their situation, and the manager, Mr. William Arrowsmith, had been at his post for over 20 years; but it was evident to the Judges, after their second inspection, that the claim could not compare with any of the other competitors, and they did not visit it on their third round.

The *Seaton Delaval Coal Company's* occupation consisted of 1,167 acres, of which 677 acres were in pasture, 120 acres meadow, 252 acres arable, and 118 acres were plantations, occupation roads, and waste. Of the arable land 16½ acres were in wheat, 91 acres oats, 10 acres barley, 11 acres beans, 48½ acres turnips and green crop, and 75 acres clover and grass seeds. The corn crops were all good, the turnips and other green crops very clean and promising, and the clover and grass seeds were heavy crops. The meadow lands were of fair average character, but the pasture land was irregular in character and three-fourths of it but poor. Some parts of the surface had sunk very much, and the drainage was therefore interfered with adversely.

Eight farm horses were kept for the farm work, and 17 milking cows, the milk of which was sold at 1*s.* per gallon for retail among the colliers, and averaged 10*l.* per week. Besides these there were 45 fatting heifers, 76 store beasts (about two years old), and 15 rearing calves.

The sheep flock consisted of 320 breeding ewes, 8 rams and 16 wethers, which, with 7 pigs, made the total number of live stock 1,024. Part of the ewe flock were half-breds, and were getting 1 lb. of oats each daily when suckling, and their best fat lambs were being sold to kill at the end of May and in June. The other part were blackfaced ewes, running with their lambs on the poorer pastures.

In all, 631 acres had been drained by the tenants, and a single wire had been fixed alongside nearly all the hedges on the farm to strengthen them as fences. A large outlay was

being made annually in feeding stuffs, lime, superphosphate, and town manure. The farm buildings had been enlarged and improved during the last thirteen years at a cost to the tenants of 2,352*l.*

Extensive collieries under the farm are worked by the Company, which employs upwards of 2,000 men and boys, and uses about 250 horses and ponies; the latter are supplied with hay and green food from the farm. A total of 3,000 tons of coal per day is got here from four pits, which are worked on an average ten days to the fortnight. The Judges had an opportunity of inspecting one of these pits, and were much interested in all they saw, and especially in the humane treatment of the ponies used.

The cottages in which the colliers reside are all owned by the Company, and number nearly 1,000, standing in long rows of upwards of 100 in each row, having a garden attached, which was cultivated to grow vegetables or flowers, as the tastes of the tenants dictated, and having butcher, grocer, baker, and general stores adjacent. The farm buildings were in good order and well arranged for the attendance and feeding of cattle in an economical manner, and the management of all the stock at pasture was wisely directed by distribution into uniform lots all over the pastures, and into the fields which were most suited to improve their growth.

A strike among the colliers existed during our second visit, and the horses and ponies had all been brought out of the pits and were enjoying unwonted liberty in three of the largest fields, though on bare pasture. It was an unusual sight to see so many together, and all stallions. The average cost of keep of each pony when in the pit was 7*s.* 6*d.* per week, though just then, in consequence of the low price of corn and hay, they could, we were informed, be kept at 11*s.* each per fortnight. It will be noticed that the number of farm stock of all kinds was but small in proportion to the extent of the holding. This fact impressed the Judges adversely. After allowing for the presence of so many horses which were confined to a limited area, and were there only for a short time, it was felt that the farm ought to carry at least 30 per cent. more live stock.

The *Cramlington Coal Company* reported, through their farm manager, Mr. Henry Storey, that they had 871 acres in occupation, 189 acres of which were in pasture, 243 acres in clover, seeds, and meadow mown for hay, 106 acres of wheat, 193 acres of oats, 105 acres of turnips, and 35 acres of potatoes, tares, and bare fallow. In their cultivation they use 26 farm horses, and feed about 50 head of cattle, 166 breeding ewes and 313 lambs, and about 50 hoggets. The land is held on lease with the collieries

from Captain Shawe Storey; it is generally a strong clay soil, with stiff or stubborn clay subsoil. It has evidently been liberally manured from the farmyard and the ashpits of the colliers' cottages. From the farmyard 1,400 to 1,500 tons of manure are annually drawn, and 2,000 to 3,000 tons of the colliery manure and night-soil from cottages.

The turnips and potatoes get the chief portion of this manure, and the fertile and mellow character of the soil showed that something like this must have been its usual dressing for some time. Thirty tons of superphosphate of bone, 25 tons special dissolved bones, 10 tons of nitrate of soda, and 600 to 1,000 tons of gas lime have also been used annually, and 300*l.* expended in cakes and purchased feeding stuffs. Part of the land has been held for 40 years, but another part only 4 years. The Company has spent 1,212*l.* in draining the land, for which the farm is charged 6 per cent. per annum. The owner had expended over 1,546*l.* in draining, for which he charged the tenants with interest at the rate of 5 per cent. per annum, and he had further drained subsided portions of the land at a cost of 827*l.* from time to time, free of interest. About 730 acres of the farm had thus been drained. One field was pointed out where the slope of the surface had been entirely changed, and where the outfall was running in an opposite direction to that of a few years before.

It will be seen that all the operations on this farm are on a large scale, and that it requires much capital and great energy and perseverance in its superintendence. In addition to this, the manager had to provide 400 tons of hay annually, and also to provide on the farm-premises chopped hay, Indian corn, beans, or other corn, for 400 horses and ponies, and deliver it daily at the several coal-pits of the Company for consumption. The relative cost of horses per week in corn and hay or grass, we were told, was, in 1886, 8*s.* $0\frac{1}{4}$*d.* each; in 1885, 8*s.* $4\frac{1}{4}$*d.*; and in 1884, 9*s.* $3\frac{1}{4}$*d.*, two ponies being counted as one horse. In 1885, 33 horses were suffocated in 10 minutes in one of the pits, and it took 436*l.* to replace them.

The green crops on this holding all looked remarkably well at our final inspection, and the corn crops very promising. The stock of cattle was of mixed character, and not as good in quality as the sheep flock. This was both well selected and skilfully managed; the ewes were of the border Leicester breed, and their lambs were being sold at nine months old for 42*s.* each. The plan followed was to distribute them over the grass land in small numbers, and to keep moving them frequently, and always, if possible, into a better pasture. The cultivation of the arable land was also done in a skilful manner. The horses, which were all geldings, were fine strong animals, were well kept, and were

made to cultivate both as deep as was needful and to step out with a speed that was born of determination on the part of the manager to have every part of the land done in proper season. Another added difficulty was the detached and widely separated lay of the holding. The knowledge of every part of it, and the prompt and equal attention given to each, were eloquent testimonies to the efficiency of the management.

These two farms, Seaton Delaval and Cramlington, adjoined each other, and were not unlike naturally. They were both being managed with good judgment and with the best friendly feeling of their managers towards each other. The latter holding, however, the Judges thought, came out best in results, and, as the published award has proclaimed, was placed higher in the scale of merit.

The *Earl of Durham's* farm consisted of 759 acres, of which 277½ were in pasture, 69½ clover, 127¾ meadow, 108 wheat, 66¾ oats, 10½ potatoes, 79 turnips, 8 mangel-wurzel, 7 tares, and 5 stack-yards and occupation roads. The stock consisted, at our second inspection, of 14 farm horses, 3 breeding mares, 2 fillies, 60 fatting bullocks and heifers, 76 store ditto, 33 ditto under two years old, 170 wethers and breeding ewes, 285 lambs, 30 rams, 315 gimmers, 104 mule sheep, 20 pigs, 37 ponies ; total, 1,149.

His Lordship is both owner and occupier of the two farms that comprise the claim. "Bowes House" contains 609 acres, and "Over the Hill" 150 acres. The latter is a medium soil on limestone ; "Bowes House" is stronger soil, on a stiff clay subsoil ; they are worked together and under a very liberal outlay for manure and feeding stuffs. About 3,200 loads of manure are annually made, and 150 purchased, which is chiefly applied to the turnip crop and to about 20 acres of old grass cut for hay. Thirty-three and a half tons of artificial manure are also used in turnip cultivation, at a cost of 31*s.* 6*d.* per acre, consisting of 2 cwt. of raw bones, 2 cwt. superphosphates, 1 cwt. guano, and 2 cwt. dissolved bones. To the old grass and seeds 17 tons superphosphates, 7 tons of salt, 3½ tons nitrate of soda, had been applied at the rate of ½ cwt. of nitrate, 1½ salt, and 2½ super. ; this cost 14*s.* per acre.

About 100 loads of gas lime are also used on the old grass land, at the rate of 8 to 10 tons per acre. The cattle and sheep are all well fatted, and the cake and corn bills amount to nearly 1,200*l.* annually. It is the practice to hold an auction sale of fat stock at Christmas and at Midsummer every year, and the Judges had the opportunity of seeing on their first inspection those which were sold on December 20, 1886. According to a statement obligingly furnished by Mr. Tully, Lord Durham's

farm manager, the sale realised 1,384*l*. 10*s*. for 49 fat bullocks, an average of 29*l*. 5*s*. each; 60*s*. 3*d*. each for 76 half-bred Cheviot wethers, and about 50*s*. each for 168 half-bred ewes. On June 6 following, 58 fat steers and heifers made 1,459*l*. 5*s*., an average of 25*l*. each, and 145 wethers averaged 53*s*. 3*d*. each, 65 gimmers 60*s*., 25 fat lambs 46*s*. 3*d*., and 7 fat ewes 59*s*. each. We learned from the newspaper reports that these sales had been in existence for 37 years, and were highly appreciated by the butchers of the neighbourhood because of the excellence of the stock and of the *bonâ fide* character of the sale.

The sale on December 12, 1887, realised 3,634*l*. 15*s*. for 140 fat cattle, and 1,652*l*. 16*s*. for 626 sheep. The whole of this stock was not fed on these two farms. Some of it came from other lands that his Lordship has in hand; but the extent of these sales and the sums realised justify the outlay on the land cultivation, and prove more than ordinary skill on the part of the manager in feeding so large and such a varied stock. Three hundred cattle and from seventeen to eighteen hundred sheep and fat lambs are annually sold. Breeding ewes are purchased in the autumn, but only once lambed, and then sold fat.

It ought to be explained that this record does not include all the land Mr. Tully had under his care, or all the stock he had to provide for and to manage. He had to make large purchases of ponies annually for his Lordship's numerous coal-pits, and to direct their breaking in and their training for the work they had to do below ground, for they were all purchased as colts and came from the Shetland Isles and from the hills of Wales. Besides the land here reported upon, his Lordship had upwards of 3,000 acres more in his own occupation, and the total number of stock in hand, as Mr. Tully informed us on our first visit, would not be less than 1,000 ponies and horses, 650 head of cattle over nine months old, and 2,300 sheep—half-breed and pure Leicesters. Large quantities of hay were purchased from adjoining tenants and sometimes from Ireland, and the estimated stock at the time was 2,100 tons, which was insured against fire for 9,000*l*. Very large quantities of Indian corn and Swedish oats were purchased, 5,000 quarters of the latter having just been bought at 16*s*. 3*d*., and 252 quarters of Indian corn at 21*s*. Swedish black oats were afterwards purchased at 15*s*. 9*d*. per quarter of 336 lbs.

The total consumption of corn last year was 10,500 quarters of oats, 520 barley, 600 Indian corn, 1,340 quarters of beans and peas, 722 cwt. of bran, 25 tons linseed, and 29 tons of cotton-cake, besides 2,000 tons of hay.

The head workmen on the place were all intelligent and capable men, and seemed to have a personal and practical inte-

rest in their work. The head shepherd had been at his post twenty-seven years.

The colliers' houses were all in good order, and their family wants, both temporal, educational, and spiritual, were well provided for by good shops, schools, and places of worship. The Co-operative Stores' principle of supplying their wants was largely adopted. Coals were supplied to them free, and were carted to upwards of 2,500 houses tenanted by the colliers and by the numerous clerks and officials.

The farm called "Over the Hill" contained 150 acres, and was known as Lord Durham's model farm. It was situated in a valley with good roads running on each side of it, and had first-class stone buildings about the centre of the land, with three cottages for workmen adjoining, all built so as to form good compact premises. There were 32 boxes for winter-feeding bullocks, with open yards, and sheds on the outside for implements and for store cattle to run under from the fields during storm or from the heat of the sun in summer. All the crops on this farm, both green crops and corn crops, were remarkably good. The fences, chiefly strong thorn hedges, were well kept and neatly trimmed, and the whole occupation beyond adverse criticism.

Bowes House Farm was not so complete, but it had extensive and substantial buildings, in which were fixed the steam-power and machinery for grinding corn, and generally preparing the mixture for the colliery ponies. There was a large and well-filled stack-yard, and a lambing-yard, with a large number of small pens around for the accommodation of a fine flock of 12 score of Leicester ewes at lambing time. About 30 shearling rams of first-class quality were being prepared for sale, and all the pastures were more than full enough of stock, because of the dry weather. Water had to be carted into troughs placed in the fields; and, said the shepherd, "We have not been so badly off for meat for 19 years on account of the drought." Notwithstanding this, the mangel-wurzel crops were both very forward and very healthy-looking. The swedes were all fresh, and covered the ground completely.

There was a large number of fine feeding bullocks and heifers in the buildings on this farm at all our visits. There were some very fine young horses in the cart stable, and a double-engined set of Fowler's steam tackle, used for ploughing the strong land. Indeed, the whole occupation bespoke not only extensive means with which to work, but great capacity in using them. We saw the hall, with its magnificent buildings and its large and well-kept gardens; the park, with its seven-mile long wall to fence it in; the colliers' cottages, the churches and

schools, and all the surroundings of an old and rich property, all being administered to with superior intelligence and devotion by all the employés from the lowest to the highest.

The Judges had ample evidence on which to base the award of the First Prize, and will not soon forget the farming they saw here, nor the farm manager's attention and readiness to show and to explain any matter in question. They thank all the competitors for their unfailing kindness and courtesy, and for the honourable action and spirit they manifested towards each other in the competition, and believe that the emulation evinced will not only benefit the winners of the prizes, but those who tried to win but did not. All deserved success if they did not all attain it in this form, and their example cannot but remain a power and a stimulant to their neighbours.

XII.—*Report upon the Spring Show of Thoroughbred Stallions at Nottingham.* By G. S. Lowe, The Hermitage, Potters' Bar.

The repeated refusals on the part of English Governments to give any real encouragement to the cause of horse-breeding may be accounted for by three reasons. First, from a general view that means will always meet extremes; secondly, from an unwillingness to create a department somewhat difficult to control; and thirdly, because there is a belief that to legislate at all upon horses has a tendency to interfere with individual interests and private enterprise.

The rapid march of events may undeceive Englishmen in the future with regard to the first undefinable reason, which is applied in like manner to all military and naval requirements. The modern historian has not been too lavish in his praise of the general organisation that marked our expedition to the Crimea in 1854–55. There were many defects at that time, when the pressure of emergency tested the most vital points of our systems.

The German-Franco campaign of 1870 taught a great many important lessons, and, chief amongst all, it showed the rapidity of war. Two great nations were in outwardly friendly relations in May, but before summer had changed into autumn the dogs of war had been let loose, several battles fought, an empire upset, and a victorious army was marching on the capital of the defeated. Such an extraordinary collapse, practically decided in a few weeks, had a great effect on armaments throughout Europe, and the political friction ever since has been caused by the

anxiety of the various Powers to keep themselves in complete readiness. England, dependent on her insular position, and on the old principle that means will meet extremes, has been more lax than her neighbours, for, at any rate, she has allowed the foreigner to strengthen his own position at her expense through an excess in the exportation of horses from these shores.

The two remaining objections to Government interference can be classed together, as, in the absence of any State control over the supply of horses, the work is left entirely to individual interest and enterprise. That such a state of things should have been allowed to exist so long is to be wondered at, from whatever side the question is viewed. English horses, through the sporting manners of the people, the climate, soil, and other essentials, are immensely superior to those that can be bred in other countries. Is it not, therefore, a source of wealth to the nation, worth preserving with the most jealous care?

The strenuous efforts of other countries to cultivate our breeds, the great expenditure allowed, and the importance of the State departments devoted almost entirely to the horse supply, should surely be sufficient to convince our rulers that this country is being made use of, and that if we husband a natural product in anything like the degree others consider it is worth, the result must be a national gain. Singularly enough, there has been no awakening to such ideas with any party holding office, albeit the question has been often enough before the country, and time after time Government studs have been proposed, besides other special encouragement.

In the opinion of the late Admiral Rous, a Haras system would be fraught with fraud and corruption, and this has been the cuckoo-cry ever since; but it seems extraordinary that a great nation should have any fear of incapacity in the control of a special department. If such conceptions were allowed, every effort in the cause of improvement and progress would come to a standstill, as there must be contractors and middlemen in almost every concern of life. It may be a subject of regret that a State stud was not established thirty or forty years ago, in consequence of the success then attending the movement in France. That country may be taken as the greatest example of how a national stock of horses can be raised in half a century; indeed, it was in France, under Napoleon the Great, that the idea was originated which has recently been put into substantial form by the Royal Agricultural Society and the Royal Commission on Horse Breeding.

There had been State Haras in France so far back as the middle of the seventeenth century; but, after an existence of 125 years, they were suppressed during the Revolution by a

decree of January 29, 1790. The second Cæsar had doubtless experienced considerable difficulties in horsing his numerous armies, and it has always been asserted that his cavalry was the weakest arm in his service. It was in accord with such circumstances, therefore, that he should devote some attention during his earliest leisure to the encouragement of horse-breeding, if only to meet his own supplies for the mighty projects he had in view. The decrees which he signed in 1805 restored the public studs, and the following year regulations were drawn up to provide for six Haras and thirty depots for stallions. Two millions of francs were devoted to the purpose, and it was decided to give premiums to the best produce bred by farmers under certain conditions, one being that a colt so primed could not be castrated without the consent of the inspector-general of the district.

There had been no racing in France at this time of any note; the sport, such as it was, being mostly in the form of matches, and competitions of a very mixed order. Consequently the stock of horses the first Napoleon deemed it wise to improve were the native breeds of the country, and a few importations. Hostilities with this country debarred him, of course, from the best source, and it is difficult to form any idea of the material upon which it was proposed to build up a very great institution.

A ten years' residence in France during the last Empire gave me the opportunity of watching very closely much of the good work done by the Imperial Haras. I must confess to impressions strongly based upon the splendid organisation of the system, and the great results derived from it, for, allowing that the first Napoleon put the plan into motion, he wrecked it again before its foundation was secure, since what could have been the position of France in regard to a supply of horses at the time the allied armies occupied Paris? In fact, no country could have been in a poorer condition, and for many years afterwards there was scarcely a good horse in the country. In 1825 it was very difficult to travel in France owing to the scarcity of horses sufficiently good to do the most moderate amount of roadwork, and the army had to be supplied from outside sources entirely. It was computed that 25,000 horses were imported annually at that time, mostly for the army, and that the exports were 3,000 only, confined entirely to the heavy breeds. This was what Louis Philippe essayed to alter, and during his reign the State stud was replenished by the first consignments of English thoroughbred stallions, and the turf was taken up under the fostering care of "La Société d'Encouragement pour l'Amélioration des Races des Chevaux."

The changes of Government in no way altered the Haras

system, excepting that the late Emperor developed a good deal that Louis Philippe had commenced, and the Imperial policy was to make the country entirely self-supplying as regards the stud of stallions. To bring this about, more encouragement was given to racing, and more first-class stallions were purchased from England. It was at this time that such horses as The Baron, Gladiator, Ion, Lanercost, Faugh a Ballagh, The Emperor, and Collingwood were secured by the French agents, and before the close of 1859 so many had been purchased as to have made the Government stud of France the greatest in the world. Once a year the list was published in the "Bulletin Officiel," and I recollect the numbers were over 400. What a wondrous amount of quality could be found in that list, with such horses in it as Weathergage, Pretty Boy, Slane, Sting, Womersley, Nunnykirk, Buckthorn, and, in fact, three parts of our stoutest and best cup horses! It was wonderful how Frenchmen could have selected them with so much judgment, as in many cases after the horses had left our shores it was discovered that their produce comprised the best of the day.

The whole system appeared to work into the right grooves, as when the horses arrived in France their locations were invariably happily chosen. I remember the little horse Saucebox, the St. Leger winner of 1856, being purchased, and he was nothing more than a pretty pony; but, given a south-country station, where the mares were big, he got beautiful stock. Then the choice was so large that nearly every breeder in France could get the horse he wanted located near him, or loaned to him; and the horses, so long as they were liked, were always retained in a district, so that they might leave a goodly number of their own stamp.

A peculiar feature of the Haras system also was the ease with which reform was brought about without in any way disturbing the institution—as in 1860, for instance, after the Flying Dutchman had been purchased for 4,000*l.*, there was a certain amount of friction between the Government and the members of the French Jockey Club. It was contended by the racing authorities that the presence of so many first-class stallions at small fees was a bar to private enterprise, since no one could afford to give a large price for a stallion against such competition. The Government conceded nothing; but, shortly afterwards, the stallions at the Chantilly depot were removed, and the Flying Dutchman alone was kept at the Paris establishment. The opportunity was taken, however, to institute premiums, much in the same fashion as the Royal Agricultural Society and the Royal Commission are giving them now; and, before the fall of the Empire, there was almost a second stud of stallions

belonging to private individuals, but still under a certain amount of State control. The connection maintained with the turf also was always of a useful character; stout runners were the horses sought for in England, and Prix des Haras and Prix Impériaux were always fixed at 4,000 metres (two miles six furlongs), and under fairly heavy conditions as to weight. It was considered also that horses capable of winning steeplechases over four miles, under twelve and thirteen stone, were likely to get the sort of horses the country required, and so such steeplechases were established for thoroughbred stallions.

The races for half- or three-parts-bred horses born in France were another important feature, and, just as the third Napoleon was completing his days of empire, the results were great indeed of what may be called two decades of the Haras system. The racing stables had more than doubled in numbers in twenty years; they were full of horses as good as could have been bred in England, with Gladiateur standing out as a specimen, at that time regarded as the horse of the century. There was no more necessity to go to England for stallions, as the horses bred in the country gave a choice much greater than the supply for the Haras required; and, to speak of the half- and three-parts-bred stock, I have seen as good a field of cross-bred French horses run in a steeplechase provided for their class, as could be found in hunter stakes in England. The horses brought out by the great Normandy breeders—the Messrs. Forcinal—were very prominent in this division, and they were the admiration of all the English hunting men who patronised the steeplechases at Vincennes.

The Anglo-Normans looked quite like a rising breed just before the war broke out, and I can recollect seeing a regiment of cavalry pass, in the neighbourhood of Paris, which in the opinion of an old English officer, who was standing near me, and who had ridden a winner in a Grand National at Liverpool, had the best horses he had ever seen under uniforms. His idea was that he could have picked fifty young hunters out of the ranks. Many of these fine regiments were, I know, annihilated at almost the outset of the war, and I suppose the disasters which befel France exhausted most of the ready stock of horses; but that had nothing to do with the Haras system.

The character of the French horses had been changed completely in a few years by a constant method of breeding from the best of English thoroughbred stallions; and from being the worst-horsed country in Europe, France was possibly one of the best in 1870. Such results are worth considering in these days, when the cry is raised that England is by no means what she used to be as regards her supply of horses; and this assurance can be given,

that if an almost barren country, such as France was in 1825, can make a horse-supply in forty years, England could replenish her stock in a fourth of that time with the advantages which she has at command.

It is not a Government movement that has come to the aid of England in this extremity; but a wave of agricultural depression has brought the public mind into a state of anxiety to make the most of all our natural resources. Enough has been seen, if the policy of France in the past is alone taken, to show what can be done by the development of a horse industry in England through the very materials that have enriched other nations. To judge such materials as others have judged them may not be the worst policy to pursue, and to adopt some of the methods of neighbouring countries may be equally wise. A national stud is not to be thought of at present; but the past year has seen the nearest approach of Government support to the cause, through almost accidental circumstances. The Royal Agricultural Society took up the subject to meet a requirement of the day, and the bestowal of a premium of 200*l.* to each of five stallions last year at Newcastle was so much appreciated by the owners of horses, and met with such general approval, as to set others thinking about a speedy advancement of the scheme.

The accidental part of the question now comes in, as it so happens that racing has altered so much in its character during the last few years as to make stakes that once appeared valuable look exceedingly paltry. It would have been out of all question to have touched a Queen's Plate ten years ago, as old-fashioned time-honoured meetings like Odiham and Egham quite depended on such events. A change has quickly come over the scene, as the old race-gatherings have collapsed altogether in the face of gate-money meetings, and stakes of 100*l.* or 300*l.* have been dwarfed by a new kind of liberality, bestowed on the principle that money makes money. An opportunity was offered, therefore, to divert the Queen's Plates, that originated in years past for the encouragement of horse-breeding, from the old lines of racing, to the system adopted by the Royal Agricultural Society and the Hunters' Improvement Society. There was practically no opposition to the proposal from either the magnates of the turf or other quarters, and hence this small State grant has become the nucleus of a movement which may achieve most of the objects of a national stud.

The appointment of a Royal Commission was the first step, to inquire into the special requirements for the grant, and to be the trustees, in fact, of the fund. The Master of the Horse, in whom has been vested the direction of the Queen's Plates

from the time such events were instituted, was by reason of his office placed at the head of such a Commission, and with his Grace the Duke of Portland were associated the Earl of Coventry, as Master of the Buckhounds, Lord Ribblesdale, who had drawn attention to the matter in the House of Lords, the Rt. Hon. Henry Chaplin, M.P., Major-General F. G. Ravenhill, Mr. Jacob Wilson, representing the Royal Agricultural Society of England, Mr. John Gilmour, representing the Highland Agricultural Society of Scotland, and Mr. J. Bowen-Jones, representing the Central Chamber of Agriculture.

The Royal Commission, after several sittings, published on December 22, 1887, its first report, in which it was recommended that the 3,000*l.* diverted with Her Majesty's sanction from the Queen's Plates, with the 2,000*l.* added by the Lords of the Treasury, should be expended in awarding premiums of 200*l.* each to twenty-two thoroughbred stallions, to be distributed over six-sevenths of England and Wales and four districts in Scotland: the remaining one-seventh of England having been provided for by the Royal Agricultural Society at its then projected spring show at Nottingham. It was decided also to hold the show of the Royal Commission in conjunction with the Royal Agricultural show, and the conditions of the newly instituted premiums were nearly the same as those decided upon by the Royal Agricultural Society—namely, to be for three-year-olds and upwards, the winner of each premium to serve not less than fifty half-bred mares, if required, during the season of 1888, and to stand or travel (at the owner's option) in the district for which he was exhibited, at a fee not exceeding 40*s.* each mare, and 2*s.* 6*d.* the groom. Powers were reserved to the Commission of providing stallions other than those competing, if, in the absence of sufficient merit, such a course was considered necessary; and this, as it proved, was a very wise provision.

The Royal Agricultural Society had by this time issued its prize schedule offering five premiums of 200*l.* each and a special gold medal for thoroughbred stallions, subject to the condition and restriction that each stallion winning a premium should serve not less than fifty half-bred mares, if required, during the season of 1888, and should stand or travel in such parts of Derbyshire, Leicestershire, Lincolnshire, Northamptonshire, Nottinghamshire, and Rutlandshire, as should be subsequently specified, at a fee not exceeding 40*s.*, except for mares belonging to members of the society, to whom the fee was to be 30*s.* In the case of the Society's premiums, the location of the stallions was to be decided by ballot, at which the local committees formed for each county would be represented. The ballot-box was not brought into requisition for the classes in

which the Royal Commission found the premium-money, as the arrangements respecting the particular location of the stallions winning premiums in the same class were left to be arranged by the owners with the approval of the Commissioners.

Twenty-seven premiums of 200*l.* each were thus provided for, to be decided at the spring show at Nottingham, held on the 9th and 10th of last February. A show of such unusual attractions was likely to receive its full share of public patronage, and the entry was sufficiently satisfactory to prove that the movement had a widespread interest. Ninety exhibitors entered stallions to the number of 105 for competition, and each district was fairly represented.

The show was held on the site of the Hay Market at Nottingham, the use of which for the purpose had been permitted by the Corporation of Nottingham, who had also generously given a grant towards the necessarily heavy expenses of erecting a large covered building for the protection of the stallions and spectators in winter-time. The organisation of the show, carried out as it was by the experienced staff of the Royal Agricultural Society, was admirable; and a special word of praise must be given to the excellence of the arrangements for the veterinary inspection, which was effected in a large space at the back of the Grand Stand. The attendance of the public was good, especially on the first day, and at times the Grand Stand was inconveniently crowded.

The Judges to whom had been confided the award of the premiums in all the classes were Lord Arthur Somerset, Mr. Robert G. F. Howard, of Temple Bruer, Lincolnshire, and Mr. J. L. Naper, of Loughcrew, Oldcastle, Ireland. The following is a list of the premiums granted in each class, an asterisk denoting those horses that, in the absence of awards by the Judges, were subsequently selected by the Royal Commission for service in districts other than those in which they were entered :—

The Royal Agricultural Society of England's Premiums.

District Class C. 24 *Entries.*

[Derbyshire, Leicestershire, Lincolnshire, Northamptonshire, Nottinghamshire, and Rutlandshire.]

No.		
7.	200*l.* and Special Gold Medal	to Isaac Clark, for *Jack Tar.*
8.	" " "	to Henry W. Freeman, for *Khamseen.*
9.	" " "	to Alexander Taylor, for *Lancastrian.*
21.	" " "	to James E. Platt, for *Silver Crown.*
23.	" " "	to W. R. Marshall, for *Tiber.*
11.	Reserve Number	to John Earle Welby, for *Lord Malden.*

Queen's Premiums offered by the Royal Commission on Horse Breeding.

District Class A. 14 *Entries.*

[Bedfordshire, Buckinghamshire, Cambridgeshire, Essex, Hertfordshire, Huntingdonshire, Middlesex, Norfolk, Oxfordshire, and Suffolk.]

No.
28. Premium of 200*l.* to the Duke of Hamilton and Brandon, for *Lion.*
32. Premium of 200*l.* to Walter Gilbey, for *Pedometer.*
36. „ „ to Lord Chesham, for *Soulouque.*
25. Reserve No. 1 to Frederick H. Jennings, for *Beau Masque.*
* 26. Reserve No. 2 to the Duke of Hamilton and Brandon, for *City Arab* (see District G).

District Class B. 11 *Entries.*

[Cumberland, Durham, Northumberland, and Westmorland.]

39. Premium of 200*l.* to William Steel, for *Blue Grass.*
41. „ „ to Robert Clarke, for *Even.*
45. „ „ to E. Hodge Banks, for *Moss Hawk.*
* 46. Reserve No. 1 to R. F. Trenholm, for *Omega* (see District K).
* 40. Reserve No. 2 to the Hon. F. W. Lambton, for *Conaglen* (see District F).

District Class D. 10 *Entries.*

[Berkshire, Cornwall, Devonshire, Dorsetshire, Hampshire, Kent, Somersetshire, Surrey, Sussex, and Wiltshire.]

50. Premium of 200*l.* to the Compton Stud Company, for *Aerides.*
52. „ „ to the Compton Stud Compnny, for *Huguenot.*
58. „ „ to Charles J. Fletcher, for *Westburton.*
*56. Reserve No. 1 to William Warren, for *Royalty* (see District H).
59. Reserve No. 2 to Samuel E. Harding, for *Young Glen Arthur.*

District Class E. 16 *Entries.*

[Yorkshire.]

64. Premium of 200*l.* to Lord Middleton, for *Escamillo.*
66. „ „ to Sir William Vavasour, Bart., for *Jarnac.*
69. „ „ to David Cooper, for *Linnæus.*
* 61. Reserve No. 1 to George W. Elliot, M.P., for *Bradgate* (see District H).
72. Reserve No. 2 to Joseph Shepherd, for *Sir Joseph.*
70. Reserve No. 3 to William Jackson, jun., for *Pursebearer.*

District Class F. 11 *Entries.*

[Gloucestershire, Herefordshire, Monmouthshire, Shropshire, Staffordshire, Warwickshire, Worcestershire, and South Wales.]

83. Premium of 200*l.* to William E. Litt, for *Q.C.*
84. „ „ to John Rees, for *Scherzo.*
(*The above two Premiums were awarded by the Judges.*)
* 40. (Reserve No. 2 in Class B) to the Hon. F. W. Lambton, for *Conaglen.* (*Selected by the Royal Commissioners for service in this district.*)

District Class G. 7 Entries.

[Cheshire, Lancashire, and North Wales.]

No.
90. Premium of 200*l.* to Sir Humphrey F. de Trafford, Bart., for *Prescription.*
93. Premium of 200*l.* to Albert O. Haslewood, for *Suleiman.*
(*The above two Premiums were awarded by the Judges.*)
* 26. (Reserve No. 1 in Class A) to the Duke of Hamilton and Brandon, for *City Arab.*
(*Selected by the Royal Commissioners for service in this District.*)

DISTRICT CLASSES H, I, J, AND K (SCOTLAND).

No awards were made by the Judges, but the following horses in other classes were subsequently selected by the Royal Commissioners for service in these districts:—

District Class H. 2 Entries.

[Aberdeenshire and district.]

* 61. (Reserve No. 1 in Class E) Premium of 200*l.* to George William Elliot, M.P., for *Bradgate.*

District Class I. 4 Entries.

[Perthshire, Fifeshire, and District.]

* 56. (Reserve No. 1 in Class D) Premium of 200*l.* to William Warren, for *Royalty.*

District Class J. 4 Entries.

[Ayrshire, Dumfriesshire, and district.]

* 47. Premium of 200*l.* to Montagu Hulton-Harrop, for *Polardine.*

District Class K. 3 Entries.

[Roxburghshire, Berwickshire, and district.]

* 46. (Reserve No. 1 in Class B) Premium of 200*l.* to Robert F. Trenholm, for *Omega.*

The report of the Judges upon the horses brought before them was in the following terms:—

Report of the Judges.

Before commencing our report upon the Stallion Show at Nottingham, we should like to express our thanks to all the officers of the Society for the civility and courtesy with which the Judges were treated by those gentlemen.

With regard to Class C, there were twenty-four entries, two of which were not brought before us. There were some useful-looking horses amongst them, and we hope the stallions that obtained a premium will do good. But in this, as in other classes, owing to so many good-looking horses having been rejected by the veterinary surgeons, the Judges were obliged to fall back upon inferior animals for premiums and reserve numbers.

In Class A, fourteen horses were entered, thirteen of which came before

the Judges; and out of the ten which were sent to the veterinary surgeons only five passed. Taken as a whole we think the class was fair. No. 28 (*Lion*),[1] which won a premium, is a well-bred horse, and was one of the best, if not the very best, all-round mover in the yard, though rather deficient in substance. It is much to be regretted that No. 38 (*Truefit*) was unsound, as he is by far the most likely-looking horse in the class to get good stock.

In Class B, eleven horses were entered, and all came before the Judges. Of these seven were sent to be examined, and two were rejected—one a particularly nice horse, No. 42 (*Friar Rush*), and the other a very useful-looking one, No. 43 (*Glenfillan*). The horses that obtained a premium in this class, No. 39 (*Blue Grass*), No. 41 (*Even*), and No. 45 (*Moss Hawk*), were decidedly good; and of the reserve horses No. 46 (*Omega*) is a very nice old horse, with great liberty, and No. 40 (*Conaglen*) is useful.

In Class D, ten horses were entered, eight of which came before the Judges. Of these seven were sent to be inspected by the veterinary surgeons, and two rejected. The three horses that obtained a premium are most useful, and the reserves would have obtained a premium in some of the other classes. No. 50 (*Aerides*) and No. 52 (*Huguenot*) are particularly good. No. 58 (*Westburton*), when he grows down, will make a very fine horse, with great substance, though a little leggy. No. 56 (*Royalty*) and No. 59 (*Young Glen Arthur*) are certainly useful.

In Class E, sixteen horses were entered, fifteen of which came before the Judges. Nine were sent to the veterinary surgeons, and three of them were rejected. It is only fair to say that there were two other horses in the class so palpably unsound that the Judges did not send them to be examined. The fact of No. 68 (*Knight Templar*) being unsound is much to be deplored, as he looks like a valuable stallion. Of the premium horses No. 64 (*Escamillo*) is a very nice compact horse; the colour of No. 69 (*Linnæus*) is against him, but he is a nice horse, and No. 66 (*Jarnac*) is a good-looking old horse, with great liberty. Of the reserve horses No. 61 (*Bradgate*) is certainly useful, and No. 72 (*Sir Joseph*) and No. 70 (*Pursebearer*) are fairly so.

In Class F, eleven horses were entered and came before the Judges. Of these eight were sent to be examined, and six were rejected, leaving the Judges a very bad selection. No. 83 (*Q.C.*) is a good-actioned horse, and No. 84 (*Scherzo*) is exceptionally good-actioned: but had No. 76 (*Albert Edward*), No. 81 (*Lammermoor*), or No. 86 (*Vibration*) passed sound, the premium horses would only have taken reserve places. No. 85 (*Somerton*), too, only just out of training, was rather a nice horse, but he also was rejected.

In Class G, seven horses were entered and came before the Judges. Of these six were sent to the veterinary surgeons, and four were rejected. Of the premium horses No. 90 (*Prescription*) is a magnificent horse, who will make a good sire, particularly of carriage horses, and would have taken a premium in any case. No. 93 (*Suleiman*) is a nice horse, but does not show the amount of power we should like to see. The fact of the unsoundness of No. 88 (*Gumbo*) is a great misfortune. No. 92 (*Returns*) and No. 91 (*Quicksilver*) are very useful-looking horses had they been sound; and the old No. 87 (*Duke of Athole*), who runs in the station omnibus at Gainsborough, has, we understand, got some very good stock.

As for Classes H, I, and K, we can only describe the horses in them as doing harm instead of good to any district. Had No. 104 (*Ratcatcher*) and No. 100 (*Barbieston*) been sound they might have been useful, but the other horses were utterly worthless.

In conclusion, we beg to draw the attention of exhibitors to the fact that,

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[1] For greater clearness the names of the stallions mentioned have been added in italics to the catalogue numbers as reported by the Judges.—Ed.

while a stallion may himself have been speedy and a good performer although pinned at the elbows, it is one of the worst faults he can transmit to his offspring.

(Signed) ARTHUR SOMERSET.
ROBERT G. F. HOWARD.
J. L. NAPER.

It may be convenient here to give also the report of the Veterinary Inspectors (Professor Brown, C.B., Sir Henry Simpson, F.R.C.V.S., and Mr. George Williams, F.R.C.V.S.), as their rejections of animals favoured by the Judges is referred to by the latter:—

Report of the Veterinary Inspectors.

Sixty-four horses were submitted for examination, and of these thirty-four were rejected as unsound.

The following summary of the causes of rejection is submitted for the information of the Royal Commission and the Royal Agricultural Society:—

Unsoundness of wind	3
Unsoundness of eyes	5
Curb	1
Unsoundness from bony deposits affecting joints: Spavin 9, Ringbone 8	17
Unsoundness from diseased feet	8
	34

(Signed) G. T. BROWN.
HENRY SIMPSON.
GEORGE WILLIAMS.

The above reports open up a large field for discussion, as—to commence with Class C, representing the division for the five premiums bestowed by the Royal Agricultural Society—the Judges complain that eight out of the fourteen sent up to the veterinary inspectors were rejected, and that in this, as in other classes, they were obliged to fall back upon inferior animals for premiums and reserve numbers. In the selection of stallions for a national purpose such as this is, the main object of all must be to prevent any inferior horse being made use of. This is one of the great points I observed in the working of the Haras system in France. The Government never gave less than 3,000 francs for a stallion, and the same rule was observed in giving premiums, of which there were two classes—one of 1,500 francs, and the other of 800 francs. The lower class, at the time I am alluding to, was the premium bestowed upon a horse worth three or four thousand francs, or say 150*l.*; but there was no sort of chance for an owner to get even 32*l.* a year for keeping an animal worth 40*l.* This seems reasonable enough, and all the more obvious and important in England, as, in giving premiums of 200*l.*, a higher class is appealed to. The object is not simply to get up a supply of cavalry horses, but to im-

prove the position of the farmer and breeder, and it is by no means a natural consequence that a horse worth less than 100*l.* should get a hunter worth 150*l.*

With all the difficulties thrown in the way of the Judges allowed, I do not think there is much to regret in the selection made for the Royal Agricultural Society's premiums. *Khamseen*, whose quarters will be Leicestershire, should be quite the breeder's friend, as, from what he could himself do on the turf and over a country, he might well get good hunters, and his beautiful colour and fine upstanding appearance are well in keeping with all that is wanted in a high-class carriage horse. *Jack Tar* is a very useful stamp of horse, and, as he has got good stock in Wiltshire, a change into Northamptonshire may be very beneficial to that county. *Silver Crown* is a very perfect-shaped animal in nearly all respects, and as his breeding is well known in Nottinghamshire, in consequence of his sire Silvester having got good hunters in a neighbouring county, the result of the ballot has given great satisfaction to the local farmers. *Lancastrian* will have more rivals to compete against in Derbyshire, a county by no means badly off for stallions; but he is a fine powerful horse, with plenty of bone and substance, and his pedigree, if it does combine the roaring strain of Longbow, is exceptionally stout by Toxophilite out of Lady Sefton by West Australian. The remaining premium stallion, *Tiber*, is rather a light-framed horse; and unfortunately the ballot has sent him back to Lincolnshire, where he has not met with much appreciation.

Many good horses of a class such as foreign agents would have been only too pleased to select from were found in all the district classes of the show, including those that had shown much the same sort of form as our old Queen's Plate horses—and these are the animals to be looked for, I feel sure. Their value also cannot be questioned, as they are well known, and evidence would not be required to prove that very large sums had been paid for them. It is creditable to the cause that such a horse as *Blue Grass* is a hunting sire, as many of an inferior class are now rated at high fees as racing stallions. He inherits old blood also, as his American ancestry takes in the blood of Lexington, and likewise of Yorkshire, a horse shipped to America many years ago, and said to have contributed a great deal towards giving stamina to both racehorses and trotters.

It was unfortunate that *Knight Templar* failed to pass the veterinary examination, as he is as nearly as possible a model of what a hunter should be like, the shape of his loins and his back ribs being just what breeders are always trying to get, as when they are built in that way, no matter whether it is a big horse or a little one, it must carry weight.

The best-looking horse, hitherto unknown at shows, was unquestionably *Aerides*, a liver-chestnut by Cremorne, out of Masdevallia by Mandrake or North Lincoln; and either way this is good hunting blood, as Mandrake got capital hunters, and North Lincoln, during the time he was allowed to serve half-bred mares down in the Vale of Aylesbury, was quite exceptional as the sire of valuable hunters, one of them selling for 600 guineas to the late Mr. Gerard Legh. *Aerides* belongs to the valuable order of hunting sire, as he was purchased for 1,000*l.* a few months ago, and it is satisfactory that he took one of the premiums.

The total collapse of the Scotch classes, both for want of merit and unsoundness, was a subject of regret; but exhibitors had only themselves to blame for it, as the want of any value or quality about these would-be premium-takers was palpable. The result showed the wisdom of having a clause in the regulations which enabled the Royal Commission to substitute other horses in classes in which no merit could be discovered; and in two cases at least very valuable substitutes were found from the reserve horses in other classes, as it is quite possible that the best hunting sire in the show was *Omega*, although, in point of make and shape, he cannot be quite accepted as a type of perfection. His stock is so good, though, and young hunters by him are realising such large prices, as to make it a subject of congratulation for the breeders of Berwickshire and Roxburghshire that he is to be at their service. The little brown horse *Polardine* also has done such yeoman service in Shropshire in getting hunters of the highest class as to make him a great acquisition on the other side of the Border.

There was certainly a diversity of quality at the Nottingham show, but the difference of size and shape gives a very wide scope to suit the many ideas on the subject of hunting sires. The Judges declined to decorate anything of the narrow spiry order, deficient in bone and substance—such a horse was *Canzoni*, beautifully bred by Petrarch out of Frivolity; and there was another son of Petrarch in Class A, with the same sort of faults, and he would not do. Petrarch himself is the most bloodlike stallion in England, to my mind; but his racing stock are often light of bone, and it may not be quite the source from which to get hunting sires. Other sons of Lord Clifden are much more likely to be useful in this direction. Hampton, for instance, was a much hardier horse than Petrarch, and his son *Somerton*, in Class F (No. 85), might be exactly the sort to get good hunters. He failed to please the Veterinary Inspectors, however, and this was the class in particular that failed so conspicuously in these examinations. It was noticeable that several of the

medium-sized bloodlike horses were included in this division, such as *Albert Edward*, own brother to the Derby winner George Frederick, *Lammermoor*, quite a quality sire in every particular, and by Scottish Chief. *Vibration* is another, justly spoken of by the Judges as belonging to a likely stamp. There was also a pretty little horse called *Canary*, but very small.

It was a little singular that very few Irish-bred horses were exhibited, for as a rule they are thought a great deal of as hunting sires. I picked out four that could claim their birthrights from the sister isle, and three—namely, *Prescription*, *Lion*, and *Soulouque*—had premiums awarded to them. *Lion*, shown by the Duke of Hamilton in Class A, and got by Rostrevor out of Queen of the Forest by Ranger, a well-known sire by Voltigeur, was decidedly the best actioned horse in the show, and, after his trotting form had been seen, the question rose in one's mind as to the value of thoroughbred horses to get roadsters. *Lion* got a premium to serve in the land of the trotters, Suffolk and Norfolk. The value of *Pedometer*, another winner in Class A, has been proved; and I liked the third honour-taker, Lord Chesham's *Soulouque*, the Irish-bred horse by Roman Bee, so exactly the sort to get hunters—and it is said that no one has ever heard of a Roman Bee being a roarer. *Soulouque* is a little high on the leg, and perhaps somewhat split up, but he has very good shoulders, and he is a bold-looking horse, such as might well be appreciated in most hunting quarters.

It was a highly representative show in a stud-book point of view, as there was scarcely a known strain without a reminder of it, however scarce it might be. For instance, there are only three horses in England by Cambuscan—namely, Camballo, Cavaliero, and *Bradgate*—and the last-named was found in the Yorkshire Class. Here also was one of the two remaining sons of the Flying Dutchman now in this country—namely, *Jarnac*—and he was one of the three premium-takers in the class. I can make no objection to the choice, as *Jarnac* is a fine old horse and the sire of a great many good hunters; but his success in this instance opens the question as to whether a limit of age should not be a future condition, as twenty years is an advanced stage of life for a country stallion.

It is considered that more hunting sires have sprung from King Tom than any other modern celebrity, and three of that line are among the twenty-seven that took premiums—namely, *Pedometer*, *Huguenot*, and *Even*. The last-named won a premium in Class B, the northern district; and his sire *Quits*, by Restitution, son of King Tom, was shown in Class C for the Royal Agricultural Society's premiums; but, however useful the

last-named has been as a hunting sire both in Lincolnshire and Shropshire, he is not as typical as his son *Even*, perhaps the most powerful horse in the show, on short legs and possessing immense bone. He well deserved his premium; and so did *Suleiman* in Class G (Cheshire, Lancashire, and North Wales), as this son of Knight of the Crescent has plenty of bone, and he is so very bloodlike. The little horses, *Royal George* by Toxophilite, and *Ratcatcher* by Young Monarque, have both credentials for getting good useful hunters; but unfortunately they failed in obtaining the necessary qualifications from the Veterinary Inspectors.

The report of the Veterinary Inspectors clears away some doubts as to why there have been so many discrepancies between the decisions of the most eminent men. It is seen from this report that seventeen out of thirty-four horses were rejected for unsoundness from bony deposits affecting joints, of which nine were from spavin and eight from ringbone. If the last terms fully implied everything, there can be little question about such horses being unsound; but the prefix about bony deposits affecting joints gives one the idea that there was a tendency in some cases to spavin or ringbone; and this is just where the difference of opinion comes in. Many people think—and I am of that opinion myself—that bony deposits in old horses must be allowed a good deal of margin, as very few horses that have been in training escape such signs of wear. I am convinced in my own mind that the Veterinary Inspectors were practically correct in all the decisions they came to at Nottingham, and, as I happened to know a good deal about most of the horses, I was pretty well aware of all they had to consider.

It is highly necessary that the public should be made completely aware of what constitutes hereditary unsoundness, and I believe that the best plan to adopt is to throw the onus on the Judges, by making the veterinary decisions simply a guide to go by in deciding the qualifications of a horse. That something will be done on the basis of some of the different suggestions which have been thrown out is probable enough; and reform in this direction is very necessary, as by the system at present in vogue the particular horses required by the country can be very easily lost sight of.

There is little doubt that the pattern taken by all the Government studs of Europe has been the English hunter. The nearest approach to such a horse is the best cavalry horse, and the best horse for general purposes, and to obtain this excellent type the foreigner has copied everything that has produced our best results much more closely than we have done ourselves. To supply the French Haras of which I have spoken our stoutest

runners were invariably purchased, and they were not transplanted about year after year from one Haras to another, but kept to do service in one quarter for many years.

What have we to say about our own best results, the results indeed that made the whole character of the English hunter, which was precisely all the French have copied? The oldest hunting sire in Lincolnshire was a horse called Lance, by Javelin, belonging to Lord Egremont. He was a King's Plate horse of some note; but, breaking a hind fetlock whilst running in a race at Ascot, he was given to a Boston blacksmith. That horse was located at Boston for more than twenty years, and is said to have set the stamp of the Lincolnshire hunter. Contemporary with, or just after him, was a horse called the Flyer, travelling between Grantham and Boston for ten years; and the horses got from the crosses of the two stallions were veritable fortunes to the Lincolnshire farmers. For three got by the Flyer out of a Lance mare a thousand pounds was offered, in those days, before the elder of the trio was six years old. Gainsborough had about nine seasons in Devonshire, and he fairly made the country into a breeding field for hunters. He was adored by the farmers, and, although it is now sixty years since he left the quarter, his name has never been forgotten. As a type of what a hunting sire should be, he must have been pretty nearly perfection—a long low brown horse, standing 15.3 on short legs, and as a performer he was the hardest worked King's Plate winner in England. There was Belzoni, again, at Lutterworth, in Leicestershire. He must have stood there seven or eight years, and for a long time no hunters were thought as good as those got by Belzoni. In later years the Ugly Buck travelled year after year from Oakham to Northampton, and it is said to this day that no other horse in the Midland counties ever did as much good.

I could go on enumerating a great number of such hunting sires, and I am quite certain that the list tells us one great secret, which is that a good horse has always made a country into a notable breeding district, for the time at least, both as regards quantity and quality. A horse starts off by getting a good batch of produce, and in four years, when his earliest offspring can be seen as young horses, their promise is favourably spoken of. The next year, perhaps, two or three sell for a couple of hundred guineas apiece, and what is the consequence? It is the talk of the country round, and there is quite a furore to send mares to the successful stallion, whilst as soon as his favours are filled another horse is patronised. If the success continues, so will the breeding; but if a farmer happens to try a chance stallion coming into his neighbourhood, and the produce is a failure, he never ceases to talk about it, and to deplore the

absence of the old horses kept in his country when he was a young man. To this I attribute the failure of nearly all the Glasgow stud horses. They never remained in one quarter long enough to be appreciated, and it was difficult to fill a subscription to one of them for fifty mares, when Theon, Ugly Buck, and Augur were getting regularly their hundred mares a year.

These ideas as to the special good a successful hunting sire can do in a country have been much strengthened by the recent result of the Grand National Steeplechase at Liverpool. It was, perhaps, one of the greatest test races of real grit and merit that has been witnessed for many years, as the weights were very high, and in a field of twenty, comprising many previous performers on the flat, the winner was simply a hunter bred by a tenant-farmer, and got by the hunting sire Ripponden, which was kept at the Belvoir Castle stables by the late Duke of Rutland for the benefit of his tenantry. The pedigree of this now famous steeplechaser's dam was unknown, but she was both hunted and worked on a farm in Leicestershire, and may be taken as the type of the ordinary brood mare, such as used to be common enough. The same class should become plentiful again if farmers would but breed from their young mares, and the chances of breeding hunters as good as Playfair should not be lost sight of.

There cannot be a better look-out for the future than that which is offered by the programme of the Royal Commission, as the sires are not necessarily changed from one quarter to another. An owner can keep his horse at home, and he has a chance to renew his premium year after year, so as to make the horse earn 200*l.* per annum. In the majority of cases the owners may be the best judges of the kind of horse best suited to different parts of the country; but great mistakes are made, as I am convinced that special strains of mares exist in many districts, very suitable for some horses, but very unsuitable for others. In the light soils, such as in Devonshire, the working animal is no other than the unfashionable-looking hunter. They have been bred on the farms for generations, and sometimes they are by a thoroughbred horse, and sometimes by the passing roadster or trotter, the latter being probably half or three parts bred. I could name farms where such horses are bred, and very seldom sold, the farmer keeping perhaps nine or ten for his work, and breeding a colt every other year to keep up the number. These are the farmers who require inducements to breed three a year; and perhaps their old-fashioned stock, full of good blood of one sort and the other, might produce the best type of general utility horse. In other districts, where the soils are heavy, and the Shire Horses or Suffolks do most of the

work, there is a new foundation entirely to be considered, as sorts are presented that have never been crossed with the thoroughbred at all. Exquisite neatness and quality are wanted here, and hence it is that horses of a smaller type are seen to do best in such quarters.

The work of the Royal Commission will demonstrate all this, as we are told in the report published on December 22 that the Commission was not prepared to extend the benefits of the grant to Clevelands, and other so-called special breeds, first on account of the inadequate amount at disposal, and secondly because the breeds mentioned required looking into, and it was the intention of the Commission to make such inquiries. In doing so, much will be learnt as to the difference of the half-bred stock in the different counties, and doubtless such information will be acted upon. The late show, if in a certain measure experimental, proved, first of all, that the thoroughbred horses in this country are by no means scarce, and there were also unmistakable signs that, despite the great increase in the value of stallions, and in like manner in fees for the production of racehorses, there is still a fair proportion of at least the best second-class available as hunting sires. Two horses that gained premiums at Nottingham have been very recently purchased, in one case for 1,200*l.*, and in the other for 1,000*l.*, and eight or ten others have changed hands at 500*l.* and upwards. This fairly signifies quality, and if a reserve list of such horses were in future at the disposal of the Commission, it can well be seen that a better class of hunting sire would become general.

The local committees which have been appointed might do good work in regulating the location of stallions. If a horse was specially liked by breeders and farmers, and, instead of getting fifty mares as stipulated by the conditions, got from eighty to a hundred, a report of the same should be made to the Royal Commission, with a recommendation that the horse should be again the recipient of the premium. This might be repeated year after year until his produce had reached the age of three, when a change might be desirable, as the system of breeding from three-year-old fillies cannot be too strongly advocated, both to increase the stock of horses in the country and for the advantage of breeding from young fresh animals. This plan would give the Royal Commission an opportunity to place horses according to their strains of blood in years to come; so that the lines of one horse might cross well with those of a predecessor.

The Royal Agricultural Society had plenty of evidence last year at Newcastle that the policy of giving valuable premiums for the encouragement of good stallions of the right stamp to get

hunters was sound, and that it was appreciated by farmers and the general public as a step in the right direction. It was then for only five stallions, and the benefits to be derived from such a small number were of course of a limited character; but it was the stepping-stone to something better, as from that beginning the Royal Commission has taken its stand. Twenty-seven stallions is still a small number to be spoken of in connection with a movement to increase the national stock of horses. The grant at the disposal of the Royal Commission on Horse Breeding is manifestly inadequate, and the insignificance of the amount appears still more apparent when it is remembered that other countries have spent millions upon what England has left to chance. The popular view of the subject has been made clear enough by all that has been seen at the two shows held under the direction of the Royal Agricultural Society, and it is to be hoped that future Governments will see the necessity of aiding in a cause that should be of the highest national importance, not only as an industry belonging specially to this country, but as a means of defence.

XIII.—*Report on the Experiments conducted in* 1887 *by Local Agricultural Societies, in conjunction with the Royal Agricultural Society of England.* By Dr. J. AUGUSTUS VOELCKER, B.A., B.Sc., Consulting Chemist to the Society.

THE scheme of co-operation between the Royal Agricultural Society and local agricultural societies for the carrying out of experiments in different districts was, it may be remembered, instituted in the spring of 1886. In that year four different societies undertook experiments, viz.:—

The Essex Agricultural Society.
The Royal Manchester Liverpool and North Lancashire Society.
The Norfolk Chamber of Agriculture, and
The Yorkshire Agricultural Society.

Besides these, the Bath and West of England had already on foot a series of experiments of their own. The results of 1886 are recorded in the report made by me in this 'Journal,' Vol. XXIII., 2nd Series, Part I. (1887), pp. 252–73.

The present is a report on further experiments conducted in 1887, the same societies taking part in them as in 1886, with the exception of the Yorkshire Agricultural Society, owing in great measure to the serious illness of Mr. John Coleman,

whose death we have since had to lament. In addition to the three societies, the Bath and West of England Society carried out an extensive inquiry on the growth of barley, in accordance with the plan they had adopted, and which has, I may say, very much to recommend it, viz. that of having one and the same experiment over a number of districts, and consequently with great variety of soil and climatic conditions. The experiments themselves while in progress were duly inspected by myself, and the local societies, as before, drew up their separate reports, which were presented at the March meeting of the Special Experiments Committee of the Royal Agricultural Society, and of which it is now my duty to present an abstract. In doing this it is a pleasure to me to congratulate the societies on the energy with which they have taken up this really important work, and on the care which has been bestowed on the efficient carrying out of the experiments. Further, I am glad to note the extended interest felt in the experiments locally by members of the several societies, feeling sure, as I do, that it is a step in the right direction.

I. Essex Agricultural Society.

(*Abstract of Report of* Mr. Bernard Dyer, B.Sc., Consulting Chemist to the Society, and Mr. E. Rosling, of Melbourne, Chelmsford.)

For the second year in succession Mr. Rosling has placed land at the disposal of the Essex Agricultural Society, and Mr. Dyer has continued the planning and direction of the experiments. My personal inspection warrants me in saying that no care has been wanting on the part of either to bring the experiments to a successful issue. Season, however, will assert its influence, and if the report of 1887 has to chronicle partial results only, it is due to the exceptional weather alone. All agriculturists know what an unfavourable year 1887 was for root crops and for the action of manures, and it is on account of such influences that those who set themselves to experiment must, like the Essex Agricultural Society, be prepared to carry out experiments, not for one year only, but for a succession of years.

A. *Experiments on Oats.*

In 1886, experiments had been conducted on mangolds, the principal crop of that part of Essex. The soil, an analysis of which was given in last year's report (p. 264), is a decidedly stiff loam of clayey appearance resting on a gravel subsoil, a soil certainly of very good quality. After a wheat crop, the

Plot	Manures per acre used for mangolds in 1886	1886 Mangolds per acre				1887 Oats					
						Bushels per acre	Weight per bushel	Straw per acre			
		tons	cwt.	qrs.	lbs.		lbs.	tons	cwt.	qrs.	lbs.
N	No dung, no artificials . .	14	12	2	20	52·18	37·25	1	0	3	24
J	12 tons dung, no artificials	22	12	1	8	65·30	38·16	1	9	2	12
C	12 tons dung, 3 cwt. superphosphate	22	10	0	16	66·40	38·31	1	11	2	0
A	12 tons dung, 3 cwt. superphosphate, 1 cwt. nitrate of soda, applied at seed-time	23	4	2	4	67·06	36·62	1	8	0	8
H	12 tons dung, 3 cwt. superphosphate, 1 cwt. nitrate soda, top-dressed in July	24	10	12	0	58·45	37·50	1	8	0	20
I	12 tons dung, 3 cwt. superphosphate, ¾ cwt. sulphate of ammonia, applied at seed-time . .	24	13	1	4	64·88	37·91	1	1	3	24
B	12 tons dung, 3 cwt. superphosphate, ¾ cwt. sulphate of ammonia, top-dressed in July	22	14	3	12	67·08	37·75	1	9	3	8
D	12 tons dung, 3 cwt. superphosphate, 2 cwt. nitrate of soda, applied at seed-time	26	0	1	20	69·98	38·12	1	12	2	0
K	12 tons dung, 3 cwt. superphosphate, 2 cwt. nitrate of soda, top-dressed in July	25	16	2	0	64·72	38·50	1	11	1	24
L	12 tons dung, 3 cwt. superphosphate, 1½ cwt. sulphate of ammonia, applied at seed-time . . .	25	0	3	0	68·67	38·91	1	10	0	4
E	12 tons dung, 3 cwt. superphosphate, 1½ cwt. sulphate of ammonia, top-dressed in July	24	7	1	4	68·83	38·06	1	12	1	8
M	12 tons dung, 3 cwt. superphosphate, 1 cwt. nitrate soda, mixed with 1 cwt. salt, top-dressed in July	24	1	0	4	60·92	39·00	1	9	0	0
F	12 tons dung, 3 cwt. superphosphate, 1½ cwt. sulphate of potash, top-dressed in July, with 1 cwt. nitrate of soda . .	23	3	0	4	59·74	38·83	1	9	1	24
G	12 tons dung, 3 cwt. superphosphate, 1½ cwt. sulphate of potash, ¾ cwt. sulphate of ammonia, applied at seed-time . .	18	13	2	16	54·37	38·25	1	8	0	8

land was dunged throughout for the mangolds. The general results, in a season which was a dry one, were that dung (12 tons per acre) could best be supplemented by the addition of nitrate of soda, which latter could be advantageously used even to the extent of 2 cwt. per acre, and that top-dressing after singling was the best mode of application; that superphosphate added to the dung gave no increase, though the experiment left it undecided whether superphosphate added to nitrogenous top-dressings increased the yield; that sulphate of ammonia did not give such good results as nitrate of soda; but that to sow it with the seed was better than top-dressing. In 1887, on the same land, oats were grown, with the object of seeing what effect, if any, the manures used for the mangolds would have on the subsequent oat crop, no fresh manure being therefore added. In the Table on page 263 are given the results both of the mangold crop of 1886, and the oat crop of 1887.

As a general result, the manure which gave the heaviest mangold crop also yielded the heaviest oat crop, $4\frac{3}{4}$ bushels of oats and 3 cwt. of straw more than from dung alone being the highest increase. Such a result, as Mr. Dyer rightly remarks, is probably due not so much to any actual residues of nitrate of soda, sulphate of ammonia, &c., applied, but to the store of food left in the soil by the rootlets of the mangold crop. The benefit from superphosphate was very slight, whilst there was none from potash manures or salt. The influence of dung over no manure was very distinct; 13 bushels of corn and 9 cwt. of straw, as well as 8 tons of mangolds in the previous year, having been the additional produce. This supplies interesting evidence of the efficiency of dung for a second season.

B.—*Experiments on Mangolds.*

Mr. Rosling having found in 1886 a high manuring to be so successful, wished to extend it still further. Whether he would in an ordinary season have been successful cannot be told; at any rate, in the present case the important factor of the weather upset all calculations, and deferred to a future year the full solution of these interesting problems. The scheme of 1886 was extended in the direction in which it had been found most profitable—viz., the use of nitrate of soda—and was further supplemented by the addition of plots in which guano and basic cinder were used. The field selected was one somewhat similar to that used the year before, but the subsoil, instead of being gravel, was white clay containing chalk nodules. It was richer in lime, potash, and phosphoric acid, and was altogether decidedly a rich soil. The analysis of it was as follows:—

Chemical Analysis of Fine Soil, dried at 212° Fahr.

Silica and silicates insoluble in hydrochloric acid	82·880
Oxide of iron	3·935
Alumina	4·880
Lime	1·568
Magnesia	·360
Potash	·594
Soda	·359
Phosphoric acid	·205
Sulphuric acid	·044
Nitric acid	·002
Chlorine	·003
Carbonic acid (combined)	·802
[1] Organic matter, water of combination, &c.	4·368
	100·000
[1] Containing Nitrogen	·147

Dung was last applied in 1885, and in 1886 an oat crop was grown with 2 cwt. of superphosphate and 1 cwt. of nitrate of soda per acre. The seed (Orange Globe Mangold) was sown on the ridge on April 12, the manures, with the exception of the top-dressings, having been placed just below the seed. The superphosphate used contained 29·78 per cent. of soluble phosphate; the Peruvian guano was one highly phosphatic in nature, containing 47·02 per cent. of tribasic phosphate of lime, with 5·07 per cent. of ammonia; and the basic cinder contained 17·16 per cent. of phosphoric acid (equal to 37·36 per cent. of tribasic phosphate of lime). The nitrate of soda was sown in various quantities up to 4 cwt. per acre. Where 2 cwt. were put as a top-dressing, the first application was on July 16, the second on July 28. Of the larger quantities, 1 cwt. was put in at seed-time, the rest at intervals. The plant was very backward, but fortunately regular, and it is certain that a quantity even of the nitrate of soda was never thoroughly washed in. The roots were pulled early in November and weighed.

After due caution as to the danger of putting an arbitrary money-value on dung, a computation of 5*s.* a ton was fixed, and in the report a table is given showing the increase due to the several manures over the produce of the unmanured plot, also the cost per acre of manuring and the cost per ton of the increased yield. The general result, however, is to show the extravagant cost of the dung, and that the increase is due to the artificials. We may, therefore, pass on to the next Table, in which the increase over the dunged plots is given; and to this Table I append the plots on which no dung was used.

The increase due to dung alone was about 2 tons only, the

Plot	Manures per acre	Mangolds per acre	Increase of crop over dunged land	Cost per acre for artificials	Cost per ton of increased yield of mangolds
		tons cwt. qrs. lbs.	tons cwt. qrs. lbs.	£ s. d.	£ s. d.
F	12 tons dung, no artificials	11 17 3 24	—	—	—
J	12 tons dung, 3 cwt. superphosphate	10 9 1 24	none	0 8 3	—
D	12 tons dung, 2 cwt. nitrate of soda	14 1 3 16	2 3 3 20	1 1 6	0 9 10
C	12 tons dung, 3 cwt. superphosphate, 2 cwt. nitrate of soda	15 12 2 24	3 14 3 0	1 9 9	0 8 0
M	12 tons dung, 4 cwt. nitrate of soda	14 5 0 24	2 7 1 0	2 3 0	0 18 2
L	12 tons dung, 3 cwt. superphosphate, 4 cwt. nitrate of soda	15 5 3 8	3 7 3 12	2 11 3	0 15 0
K	12 tons dung, 4 cwt. basic cinder, 4 cwt. nitrate of soda	14 18 0 24	3 0 1 0	2 10 0	0 16 8
B	12 tons dung, 2 cwt. guano	14 1 0 24	2 3 1 0	0 14 6	0 6 9
E	12 tons dung, 2 cwt. guano, 2 cwt. nitrate of soda .	14 11 3 4	2 13 3 8	1 16 0	0 13 4
G	12 tons dung, 4 cwt. guano,	16 4 3 12	4 6 3 16	1 9 0	0 6 8
H	12 tons dung, 4 cwt. guano, 2 cwt. nitrate of soda .	18 4 0 12	6 6 0 16	1 16 0	0 5 9
I	12 tons dung, 4 cwt. guano, 4 cwt. nitrate of soda .	18 19 2 12	7 1 2 16	3 12 0	0 10 2
			increase over unmanured land		
A O	No dung, no artificials Ditto ditto } mean	9 18 0 4	—	—	—
R	No dung, 4 cwt. nitrate of soda	13 6 2 16	3 8 2 12	2 3 0	0 12 6
N	No dung, 4 cwt. basic cinder, 4 cwt. nitrate of soda	12 7 2 20	2 9 2 16	2 10 0	1 0 2
P	No dung, 3 cwt. superphosphate, 4 cwt. nitrate of soda	16 19 2 16	7 1 2 12	2 11 3	0 7 3
Q	No dung, 6 cwt. guano, 4 cwt. nitrate of soda . .	18 18 0 0	8 19 3 24	4 6 6	0 9 7

estimated cost being 3*l.* per acre, or 30*s.* per ton of increased crop. It is probable that, as last year, superphosphate added to dung did no good, though I must regard as accidental the lower yield of plot J as compared with F. In last year's experiments the produce was nearly identical on both plots. A comparison of plots D and C, as also of R and P, would lead to a conclusion favourable to the use of superphosphate, at least when used with nitrogenous manures. Nitrate of soda, 2 cwt. per acre, would appear to have produced about 2 tons additional crop, and 4 cwt. nitrate of soda to have been more effectual than 12 tons of dung. Basic cinder proved inferior to superphosphate; but the results obtained with guano were decidedly satisfactory, 2 cwt. per

acre having given about the same result as 2 cwt. of nitrate of soda, viz. 2 tons per acre over the dung produce; 4 cwt. of guano per acre doing still more.

Looking at the results from an economical point of view, the best results were given by plots P and Q where no dung was applied, P (3 cwt. superphosphate, 4 cwt. nitrate of soda) yielding an increase of over 7 tons per acre, at a cost of 7*s*. 3*d*. per ton of increase, and Q (6 cwt. guano, 4 cwt. nitrate of soda) 9 tons per acre increase, at a cost of 9*s*. 7*d*. per ton. Omitting the cost of dung, the guano plots H (4 cwt. guano, 2 cwt. nitrate of soda), G (4 cwt. guano), and B (2 cwt. guano) gave the best returns.

Mr. Dyer made analyses of roots taken from the different plots, and these showed the average percentage of dry matter to be about 14½, which is a high figure, 12 per cent. being in any ordinary season about the average. There were, therefore, much more dry matter and less water in the roots than is usual, the roots being thus much richer.

The total rainfall from January to the end of October was only 12·03 inches, and the soil was very parched. The principal conclusions drawn are these:—

1. That, owing probably to the extreme dryness of the season, dung alone produced a comparatively small effect at an extravagantly high cost.

2. That the addition of artificials to the dung increased the yield considerably at a relatively diminished cost.

3. That the most efficacious artificials as additions to dung, both as regards increased yield and cost of increased produce, were guano and nitrate of soda used together.

4. That artificials alone proved much more economical than dung, or any mixture of dung and artificials.

5. That nitrate of soda, whether with or without dung, did not produce its maximum effect without the addition of phosphatic manure, such as guano or superphosphate.

6. That basic cinder, although it increased the crop, did not act as well as superphosphate.

7. That the roots, almost throughout the field, contained much more dry or solid matter, and therefore less water, than roots grown in an ordinary season.

In consequence of the dryness, which doubtless prevented the manures from exercising anything like their full benefit, as seen in the small produce, the Essex Committee considered it desirable to repeat these experiments another year. The Experimental Committee of the Royal Agricultural Society think this a very wise course to adopt, and they further recommend that the tops be weighed as well as the bulbs.

II. The Royal Manchester Liverpool and North Lancashire Agricultural Society.

The Experimental Committee of this society, under the direction of Mr. Smetham, the society's chemist, and Mr. Holland, their botanist, decided upon carrying out experiments on the laying down of grass for permanent pasture, and also for one, two, three, and four years' ley, these subjects being of the most importance in the districts in which the experiments were to be conducted.

The society has two stations, one at Saltney, near Chester, and the other (more recently added) at Rostherne, on the estate of Lord Egerton of Tatton.

A.—*Grass Experiments at Saltney, near Chester.*

The field selected is in the occupation of Mr. John Roberts, and is 17 acres in extent. The soil is a strong one, 10 to 12 inches deep, with a clay subsoil. Wheat was the crop in 1885, oats following in 1886. Five acres were laid down with mixtures of grass-seeds suitable for permanent pasture, whilst five other acres, comprising ten half-acre plots, were laid down with different mixtures of clovers and grass-seeds, for one, two, and three years' ley. Besides this, specimen plots of the clovers and grasses were sown, and other plots laid out for the cultivation of different varieties of potatoes.

All the plots were pastured up to March 28, 1887, and the whole then manured with 3 cwt. of bone manure per acre. Each plot was then divided, one half being hurdled off for mowing, and the other half left to be fed. The hay was mown on July 2.

Mr. Holland remarks, with regard to the effect of mowing permanent pastures during the first year, that the root was clearly not so thick on the mown as on the unmown portions; and that this effect was felt by the grasses rather than the clovers, which latter seem to have suffered little. In the case of the rotation plots the object is of course a different one, viz. to get as much bulk as possible during the first year. Of the different grass-mixtures plot 3 in the permanent pasture series (composed of the stronger grasses only) seemed to be eaten off best; and among the rotation grasses plot 6. The mixtures of seeds sown per acre in each case were as follows:—

Plot No. 3.

2 lbs. Italian Ryegrass.	4 lbs. Meadow Foxtail Grass.
6 ,, Cocksfoot Grass.	4 ,, White Clover.
5 ,, Meadow Fescue Grass.	1 ,, Red Clover.
3 ,, Tall Fescue Grass.	1 ,, Alsike Clover.
3 ,, Timothy Grass.	

PLOT NO. 6.

4 lbs. Italian Ryegrass.	3 lbs. Timothy Grass.
6 „ Cocksfoot Grass.	3 „ Red Clover.
3 „ Meadow Fescue Grass.	1½ „ White Clover.
2 „ Tall Fescue Grass.	1½ „ Alsike Clover.
2 „ Meadow Foxtail Grass.	

As regards permanent pasture mixtures, no great difference can be noted; and, indeed, time alone can settle the matter, some grasses, *e.g.* Meadow Foxtail, only showing the fourth year.

As far as the experiments on rotation grasses have gone, they would appear to be all against complicated and expensive mixtures, plot 14 (22 lbs. Italian Ryegrass, and 10 lbs. American Red Clover) having done as well as anything. Mr. Holland especially comments on plot 1, a cheap mixture which has formed a wonderfully thick sward and covered the ground very quickly, and which was composed as follows:—

PLOT NO. 1.

24 lbs. Devonshire Evergreen Ryegrass.	4 lbs. Wild White Clover.
4 „ Crested Dogstail Grass.	½ „ Sweet Vernal Grass.

He adds that, though probably not generally to be recommended on low-lying lands, on poor land and in elevated positions such a mixture would be found very useful as a sheep pasture. Of the separate specimen plots, that of Bird's-foot Trefoil (*Lotus corniculatus*) was the best and the most sought after by the sheep when put on it: so much so, indeed, that they went on it at the first opportunity and kept it bare. On the plot containing it as a constituent of the mixture, the same luxuriance was noticed. Mr. Holland says there appears to be some difficulty in getting the seed pure, but attention should certainly be directed to its further cultivation.

B.—*Grass Experiments at Rostherne.*

This, the second experimental station, had its origin in the liberality of Lord Egerton of Tatton, who, besides bearing the cost, has placed at the society's disposal every facility for carrying out the experiments. Upon a field planted one half with wheat and the other half with oats, seeds both for permanent pasture and for four years' and two years' ley were sown in the spring of 1887. The plots are half an acre each in extent, each mixture being sown in duplicate, in the one case in the wheat crop, and in the other in the oats. The dry summer of 1887 has unfortunately militated greatly against obtaining a good plant, and there is at present nothing special to record about this experiment.

III.—Norfolk Chamber of Agriculture.

The annual report of the Chamber contains the account of another year of activity in the prosecution of experimental enquiry, and in this Mr. F. J. Cooke, of Flitcham, has again been indefatigable in his efforts, while Mr. Garrett Taylor and Mr. Sapwell have been his able supporters.

Further experiments on barley have been carried out on the farms of the above gentlemen under varied conditions:—

A.—*Experiments on Barley after Roots drawn off the Land.*

(*a*) Mr. Taylor's Farm at Whitlingham.

Plot	Manures per acre	Produce per acre			
		Head-corn	Straw		
		bushels	cwt.	qrs.	lbs.
1	1 cwt. nitrate soda; 2 ,, superphosphate	44·37	33	1	16
2	*Nothing*	36·25	23	1	12
3	2 cwt. nitrate soda; 2 ,, superphosphate; 1 ,, muriate potash	49·87	37	3	20
4	$1\frac{1}{2}$,, sulphate ammonia; 2 ,, superphosphate; 1 ,, muriate potash	42·50	31	1	0
5	$\frac{3}{4}$,, sulphate ammonia; 2 ,, superphosphate; 1 ,, muriate potash	42·12	32	1	24
6	1 ,, nitrate soda; 1 ,, muriate potash	49·25	32	2	12
7	$1\frac{1}{2}$,, nitrate soda	40·78	28	1	8
8	1 ,, nitrate soda; 2 ,, superphosphate; 1 ,, muriate potash	42·12	30	1	4
9	*Nothing*	34·62	25	0	0
10	2 cwt. superphosphate; 1 ,, muriate potash	33·34	24	1	0
11	$1\frac{1}{2}$,, guano (10 per cent. ammonia)	37·93	28	1	16
12	Roots folded with sheep and a dressing of 3 cwt. fish salt, sown March 8	52·50	39	0	16
13	Duplicate—Roots folded, &c.	53·12	40	1	25

Here barley followed swedes, which had been manured with 4 cwt. of bone-flour, 1 cwt. of sulphate of ammonia, and 1 cwt. of gypsum per acre, the produce being nearly 20 tons. Mineral manures were sown for the barley on February 17, the barley, guano, and sulphate of ammonia being put in March 7–9, and the nitrate of soda top-dressing April 7. The produce of the unmanured plots, even in a season like the last, was a high one, viz. $35\frac{1}{2}$ bushels per acre, which gives an idea of the fertility of the land. In consequence the increased produce due to the

manures could not be exceptionally large. Sulphate of ammonia in such a dry year did not equal nitrate of soda in its results. The highest yield was where 2 cwt. nitrate of soda per acre was used in conjunction with superphosphate and muriate of potash, viz. 49 bushels. Judging from plot 7, minerals would seem to have helped the produce. Though plot 3 gave the highest and an excellent return, the best-paying one was from plot 1 (1 cwt. nitrate of soda, and 2 cwt. superphosphate). In last year's similar experiment, 2 cwt. superphosphates, 1 cwt. nitrate of soda, and ¾ cwt. muriate of potash per acre did best. The results this year differ, therefore, only in respect to the advantage of using the additional small quantity of potash-manure.

(*b*) Mr. Cooke's Farm, Flitcham (Old Sainfoin Field).

In this case white turnips was the crop drawn off. Mr. Cooke here carried out a plan which both he and I had, for some time previously, had in contemplation, viz. by experimenting on land which was known from previous experience to require potash, to ascertain in what form it could be best supplied. In the combinations of potash used on plots 1, 2, and 5, approximately the same quantity of potash (K_2O) per acre (about 56 lbs.) was applied in each case; a rather less amount was given to plot 6 (49 lbs.), and a double amount (112 lbs.) to plot 7. The results were as follows :—

Plot	Manures per acre	Produce per acre: Head corn	Produce per acre: Straw
		bushels	cwt. qrs. lbs.
1	3 cwt. superphosphate 1 „ muriate potash 2 „ nitrate soda	33·12	23 1 20
2	3 „ superphosphate 4 „ kainit 2 „ nitrate soda	28·62	20 3 20
3	3 „ superphosphate 2 „ nitrate soda	16·37	14 0 20
4	2 „ nitrate soda	20·62	13 1 12
5	3 „ superphosphate 1 „ sulphate potash 2 „ nitrate soda	34·50	19 2 0
6	3 „ superphosphate 1 „ nitrate potash 1¼ „ nitrate soda	37·12	20 2 16
7	3 „ superphosphate 2 „ muriate potash 2 „ nitrate soda	37·73	24 3 3

The barley was sown on February 16, the mineral manures being put on the day before, and nitrate of soda as a top-dress-

ing subsequently, in two lots. The need of potash is shown by the low produce of plots 3 and 4. Plot 3 (nitrate of soda and superphosphate) was indeed the lower, but this was perhaps due, as Mr. Cooke says, to the situation of plots 1, 2, and 3 not being as good as that of the rest. The kainit also probably did not give thoroughly satisfactory results owing to this cause; at any rate, it did not give as good results as were obtained from the use of 1 cwt. per acre of either sulphate of potash or muriate of potash, which gave about an equal return. The sulphate of potash produced rather more corn, the muriate more straw. The best results, however, were obtained by using 1 cwt. nitrate of potash per acre, the quantity of nitrate of soda being reduced on this plot so as to give the same application of nitrate on this plot as on the others. The yield, it will be noticed, was nearly as high as on the plot on which double the amount of potash, as muriate, was used. These are interesting results, which will well bear repetition.

B. *Experiments upon Barley after Barley.*

Mr. Cooke's Farm at Flitcham (Houghton Field).

This experiment was similar in some respects to the last-mentioned, the relative effect of kainit and muriate of potash being tried where barley followed barley. Common salt was also used on one plot to see whether the beneficial results which Mr. Cooke had obtained with muriate (chloride) of potash were due to the potash, or possibly to the chlorine, in which latter case common salt (chloride of sodium) should have answered as well. The results were as follows:—

Plot	Manures per acre	Produce per acre	
		Head corn	Straw
		bushels	cwt. qrs. lbs.
1	½ cwt. muriate potash; 3 „ superphosphate; 2 „ nitrate of soda	27·37	18 0 16
2	2 „ kainit; 3 „ superphosphate; 2 „ nitrate of soda	27·75	18 0 16
3	3 „ common salt; 3 „ superphosphate; 2 „ nitrate of soda	23·37	15 3 12
4	2 „ nitrate of soda	16·50	10 0 12

Nitrate of soda alone was practically the *nothing* plot. Salt with superphosphate increased the yield by 7 bushels; but both the muriate and the kainit added yet another 4 bushels, and between them there was nothing to choose.

C. *Experiment on Barley (unmanured) after Mangolds (manured).*

MR. TAYLOR'S FARM (WHITLINGHAM).

This experiment was to test the value, for a barley crop, of the residue from the manures applied for the mangolds of the year previous. The following table gives the results:—

PLOT	Manures per acre applied for mangolds in 1886	Produce per acre			
		Head-corn	Straw per acre		
		bushels	cwt.	qrs.	lbs
1	20 loads dung	43·00	26	2	4
2	10 loads dung; 2 cwt. nitrate of soda	41·25	27	3	8
6	4 „ superphosphate; 2 „ nitrate soda; 3 „ common salt	38·50	25	0	24
7	4 „ superphosphate	28·00	17	3	12
13	3 „ superphosphate; 4 „ fish guano; 1 „ muriate potash	43·87	26	2	12

As to the difference between plots 6 and 7, it is stated in the report to the Norfolk Chamber that plot 7 was almost certainly inferior land, having produced 2 tons per acre less roots than the unmanured plots, and over 13 tons less than plot 6. Mr. Cooke discusses the interesting question whether irregularity of soil alone accounts for the high result on plot 6, or whether there is a residue from the nitrate of soda applied the year before and still available for the succeeding barley crop. He inclines to the belief that the latter may have been the cause, after such an exceptionally dry season, and estimates that about 4 bushels of the increase was due to it. I am afraid I can hardly follow Mr. Cooke in this. I would direct attention to a similar case occurring in the Essex experiments on oats after mangolds recorded in an earlier part of the present paper, where Mr. Dyer makes what I think to be a very pertinent remark—viz., that the increased corn crop after a heavier mangold crop is due in all probability rather to the large accumulation of plant food in the rootlets of the heavier mangold crop than to any residue from nitrate of soda. At all events from plots so varying it would be unwise to draw a definite conclusion. Fish guano in the second year appears to have told well.

D. *Experiment on Mangolds after Wheat.*

Mr. Sapwell's Farm (Aylsham).

This was undertaken chiefly with a view to determining whether superphosphate was of use for mangolds, to see how

Plot	Manures per acre	Roots per acre				Tops per acre			
		tons	cwt.	qrs.	lbs.	tons	cwt.	qrs.	lbs.
1	3 cwt. of salt 1 „ nitrate of soda 1 „ nitrate of soda top-dressing	20	5	3	16	5	0	0	0
2	4 „ superphosphate 3 „ salt 1 „ nitrate of soda 1 „ nitrate of soda top-dressing	22	8	3	20	5	7	2	0
3	*Nothing*	14	1	1	0	3	1	1	0
4	3 cwt. salt 2 „ nitrate of soda 2 „ nitrate of soda top-dressing	21	1	3	4	5	10	3	6
5	4 „ superphosphate 3 „ salt 2 „ nitrate of soda 2 „ nitrate of soda top-dressing	21	11	0	8	5	6	3	4
6	4 „ superphosphate mixed with ½ „ bone-flour 1 „ nitrate of soda 1 „ nitrate of soda top-dressing	17	7	3	12	3	11	3	4
7	4 cwt. superphosphate 3 „ salt 1 „ muriate of potash 1 „ nitrate of soda 1 „ nitrate of soda, top-dressing	19	12	3	2	3	14	2	26
8	4 „ superphosphate 1 „ muriate of potash 1 „ nitrate of soda 1 „ nitrate of soda, top-dressing	19	2	2	0	4	10	0	10
9	10 loads dung 3 cwt. salt 1 „ nitrate of soda 1 „ nitrate of soda, top-dressing	20	16	1	10	4	0	0	0
10	*Nothing*	13	0	0	20	3	6	2	22
11	10 loads dung 3 cwt. salt 1 „ sulphate ammonia 1 „ nitrate of soda, top-dressing	21	14	3	8	5	4	0	22
12	10 loads dung 3 cwt. salt 1½ „ guano 1 „ nitrate of soda, top-dressing	19	18	3	0	4	6	2	2
13 Ordinary farming	10 loads dung 5 cwt. fish salt 3 „ superphosphate 3 stone bone-flour 1 cwt. muriate of potash ½ „ nitrate of soda 1 „ nitrate of soda, top-dressing	19	16	1	20	4	10	0	0

nitrate of soda could best be used, and if common salt were a useful or necessary adjunct to muriate of potash. The results are given in the table on page 274.

On comparing the plots 1 and 2, and also plots 4 and 5, the addition of superphosphate will be found to have given about 2 tons more in the first case and half a ton more in the second. The Norfolk experiments of 1886 and 1887 have consequently shown no very decisive advantage from the use of superphosphate for mangold, at least on the particular land experimented on. The addition of a small quantity of bone-flour to superphosphate would not appear to be required, and the joint use of salt and muriate of potash was evidently not requisite. Lastly, the smaller dressings of nitrate of soda were equally efficacious with the larger, but the season may have had much to do with this in not effectually washing in these top-dressings.

Further experiments were carried out at Whitlingham, Aylsham, and Flitcham, upon swedes, but the results, owing to the dry season, are of very uncertain nature. The report to the Norfolk Chamber contains also records of several additional experiments (*e.g.* on pasture, rotation seeds, clover, sainfoin, &c.) conducted by the Chamber on their own account, and more specially of local interest.

A meeting of the Special Experiments Committee of the Royal Agricultural Society of England was held at 12, Hanover Square on March 6, 1888, when delegates from various local societies attended, and the reports, of which the foregoing is an abstract, were duly presented. In the course of the discussion an opinion was expressed, and appeared to meet with general approbation, that it would be very desirable in a future year to plan one particular experiment to be carried out simultaneously in their several districts by the local societies affiliated for this purpose with the Royal Agricultural Society.

XIV.—*Report on the Field and Feeding Experiments at Woburn, conducted on behalf of the Royal Agricultural Society of England during the year* 1887. By Dr. J. Augustus Voelcker, B.A., B.Sc., Consulting Chemist to the Society.

Experiments on the Continuous Growth of Wheat.

The experimental plots were prepared for sowing at the beginning of October 1886. Mineral manures were sown on October 11, and Browick wheat at the rate of 9 pecks per acre was dibbled in, October 13–16. The wheat was well up by November 16,

and there was a good plant throughout the season. The farmyard manure for the dunged plots 10B and 11B was made by four Hereford bullocks which were put in the pits and fed for 21 days, November 22 to December 13. During this period they consumed:—decorticated cotton-cake, 2 cwt. 2 qrs.; maize-meal, 4 cwt.; white turnips, 30 cwt.; wheat-straw chaff, 5 cwt.; and they were supplied with 12 cwt. of wheat-straw as litter.

The dung after being made was removed from the pits and kept under cover until February 11, 1887, when it was found to weigh 24 cwt. 1 qr. 26 lbs. On the same day plots 10B and 11B were dressed with the dung in quantity to supply per acre respectively 100 lbs. and 200 lbs. of ammonia.

Throughout January there was continued frost, but the wheat did not appear to suffer at all. The cold weather, accompanied with snow at intervals, continued throughout February, right on to March 21, when it broke. The plots were harrowed on March 28; transplanting was done on April 1, hoeing on April 13, followed by horse-hoeing. The nitrogenous top-dressings of ammonia-salts and nitrate of soda were sown on plots 2, 3, 5, 6, 8A, and 9A, on April 29. Rain fell on May 2, 3, and 4, and washed the manures in well. By May 7 the weather had turned warm, and the top-dressings of nitrate of soda had already by that time begun to tell. The effects of the ammonia-salts were also visible by May 9. On May 12, the plots were hoed the second time. The plots on which nitrate of soda had been put appeared throughout stronger than those dressed with ammonia-salts, the more ready solubility of the former telling in the dry season. The wheat grew well, and, during the long drought which succeeded the rain of June 3 and continued till after harvest, it did not appear to suffer much, forming a striking contrast to the shallower-rooted barley. It has before been remarked that the soil of Stackyard Field, though so light in character, is well adapted for suffering extremes both of wet and drought; its open character, especially with a plant like wheat, enabling the rootlets to find their way readily to the lower and moister levels of the subsoil. Plot 9A (heavy dressing of nitrate of soda) was a big crop and went down somewhat, appearing too much for an ordinary season. Plot 6 (smaller dressing of nitrate of soda) on the contrary stood up well, as did plot 5 (smaller dressing of ammonia-salts). Towards harvest it was noticeable that the plots 2 and 5 (ammonia-salts) ripened some considerable time before the corresponding nitrate of soda plots. Plot 3 (nitrate of soda alone), like 9A, went down somewhat.

On August 5, after close examination of the wheat plots, *puparia* of the Hessian fly were found on some of them; other

fields in the neighbourhood had also been visited by this pest. By August 9 the attack had extended to all the wheat plots; specimens were collected and forwarded to Miss Ormerod, the Society's Consulting Entomologist, for identification, and she reported on the attack as being that of the Hessian fly. Considerable damage was also done by the corn saw-fly. Coming so near harvest, it would appear that the Hessian fly attack had but a trifling effect on the crop, which was cut on August 15, and stacked in the field on August 19. The straw was cut rather high up, and the stubble turned in at once, to prevent further mischief. The corn was thrashed October 18–21, dressed and weighed October 25–28. The results are given in Table I., page 278.

The plots are $\frac{1}{4}$-acre ones, with the exception of the A's and B's, which are $\frac{1}{8}$ acre each.

The season, a very dry one, was not on the whole unfavourable to the wheat crop, and the results stand considerably above those of last year. They resemble nearly the produce of 1885, and are decidedly above the average of the last ten years. On the unmanured plots the yield was 21·3 bushels and 24·6 bushels per acre against 12·2 bushels and 14·5 bushels in 1886, the average of the ten preceding years being 17 bushels. Mineral manures used alone gave even a poorer result, viz. 17·7 bushels.

Ammonia-salts proved decidedly inferior to nitrate of soda this year as a top-dressing; this was probably due in great measure to the extreme drought. When ammonia-salts were used alone, the increase was only 3 bushels over the average of the unmanured plots, but with nitrate of soda the highest produce since 1881 was obtained—viz. 35 bushels. Combined with mineral manures, ammonia-salts (200 lbs. per acre) gave only 3 bushels more, but nitrate of soda (275 lbs. per acre) similarly combined yielded 40·2 bushels, or nearly 8 bushels more than the average. When double the amounts of ammonia-salts and nitrate of soda were used, 36·5 bushels in the one case and 43·8 bushels in the other were obtained. The omission of these nitrogenous manures for a single year (they having been applied last in the spring of 1886) reduced the produce to 27·4 bushels and 20·3 bushels. It would thus appear that there was more residue remaining from the previous application in 1886 of ammonia-salts than from that of nitrate of soda, the crop on the nitrate plot being even below the unmanured one. In the case of the dunged plots, the application of four tons per acre produced some benefit, the yield being 30·2 bushels; eight tons of dung gave 36·9 bushels per acre. Where no dung had been applied since 1882, there was still an increase of three or four bushels above the unmanured crop.

TABLE I.—PRODUCE OF CONTINUOUS WHEAT. ELEVENTH SEASON, 1887.

Plots	Manures per Acre	Produce per Acre: Dressed Corn: Weight	Number of Bushels	Weight per Bushel	Straw, Chaff, &c.		
		lbs.		lbs.	cwts.	qrs.	lbs.
1	Unmanured	1,290	21·3	60·45	17	3	11
2	200 lbs. ammonia-salts, containing 50 lbs. ammonia	1,541	26·1	59·08	22	1	14
3	275 lbs. nitrate of soda, containing Nitrogen = 50 lbs. ammonia .	2,071	35·0	59·16	29	0	10
4	200 lbs. sulph. potash, 100 lbs. sulph. soda, 100 lbs. sulph. magnesia, 3½ cwts. superphosphate of lime .	1,063	17·7	60·06	16	2	16
5	200 lbs. sulph. potash, 100 lbs. sulph. soda, 100 lbs. sulph. magnesia, 3½ cwts. superphosphate of lime, and 200 lbs. ammonia-salts	1,697	29·7	57·14	28	3	26
6	200 lbs. sulph. potash, 100 lbs. sulph. soda, 100 lbs. sulph. magnesia, 3½ cwts. superphosphate of lime, and 275 lbs. nitrate of soda . . .	2,373	40·2	59·12	37	1	22
7	Unmanured	1,378	24·6	55·92	19	2	26
8A	The same minerals as in 8B, and 400 lbs. ammonia-salts	2,050	36·5	56·25	36	3	12
8B	200 lbs. sulph. potash, 100 lbs. sulph. soda, 100 lbs. sulph. magnesia, 3½ cwts. superphosphate of lime .	1,514	27·4	55·33	23	0	2
9A	The same minerals as in 9B, and 550 lbs. nitrate of soda	2,526	43·8	57·75	45	2	8
9B	200 lbs. sulph. potash, 100 lbs. sulph. soda, 100 lbs. sulph. magnesia, 3½ cwts. superphosphate of lime . .	1,200	20·3	59·25	17	2	8
10A	No manure (having received manure as 10B in each of the five seasons previous to 1882, but none in 1882 or since)	1,510	26·4	57·17	21	0	8
10B	Farmyard-manure, estimated to contain nitrogen = 100 lbs. ammonia, made from 672 lbs. decorticated cotton-cake, 1,075 lbs. maize-meal, 8,064 lbs. turnips, 1,344 lbs. wheat-straw, as food; and 3,174 lbs. wheat-straw as litter. Weight about 4 tons	1,716	30·2	56·83	25	3	22
11A	No manure (having received manure as 11B in each of the five seasons previous to 1882, but none in 1882 or since)	1,578	27·8	56·67	22	1	24
11B	Farmyard-manure, estimated to contain nitrogen = 200 lbs. ammonia, made from 1,344 lbs. decorticated cotton-cake, 2,150 lbs. maize-meal, 16,128 lbs. turnips, 2,688 lbs. wheat-straw chaff, as food; and 6,348 lbs. wheat-straw as litter. Weight about 8 tons	2,094	36·9	56·88	31	2	4

Experiments on the Continuous Growth of Barley.

The farmyard manure for the plots 10B and 11B was made by four Hereford bullocks which fed for twenty-one days at the same time, and consumed the same amount and kinds of food as those which made the dung for the continuous wheat plots. The dung, after removal from the pits, was put under cover, and weighed on February 23, 1887, being then applied to the plots 10B and 11B, so as to supply to them 100 lbs. and 200 lbs. of ammonia per acre respectively. The plots were ploughed and rolled February 28 to March 3, and mineral manures sown broadcast on March 8, and harrowed in. The barley, nine pecks per acre of "Golden Melon," was drilled on March 22. Owing to continued cold weather it was slow in showing itself, but came through about April 16. It made, however, but little progress, and the growth throughout was unsatisfactory—first the cold and then the drought being altogether against it, causing the yield to be small and the straw exceptionally short. The plots were harrowed April 18–23. On May 5 nitrogenous top-dressings (similar to those used for the wheat) were sown. Rain fell on the next day, and the effect of the nitrate of soda was clearly discernible on May 18. By May 21, the ammonia-salts also showed slightly the result of their action. During June and July there was a long spell of drought, in the course of which the barley felt very much the want of rain. The nitrate of soda plots, as with the wheat, were stronger than those dressed with ammonia-salts; but here again the ammonia plots ripened more quickly, though the manure appeared to impart to the crop a sickly reddish colour. Very striking also was the effect of mineral manures added to nitrate of soda (plot 6) as compared with nitrate of soda alone (plot 3), the minerals appearing to produce much earlier ripening.

The Hessian fly, which attacked the wheat on May 5, did not so early attack the barley, but by August 9 it appeared on all the plots, though apparently doing but little damage. The barley, which was a poor short crop, was cut on August 15, and carted and stacked August 18; the ground was ploughed immediately after and the stubble turned in, to prevent future damage from the Hessian fly. The barley was dressed and weighed October 25–28; the results are given in Table II., page 280.

As in 1886, the produce was a very low one, the results of the two years being very similar, and considerably below the average of the preceding ten years. The straw was also very short, and in the case of one plot only (plot 9A, mineral manures with 550 lbs. nitrate of soda) was the general average reached. The unmanured plots yielded 19·9 bushels and 20·4 bushels per acre, against 19·2 bushels and 18·2 bushels last

TABLE II.—PRODUCE OF CONTINUOUS BARLEY. ELEVENTH SEASON, 1887.

Plots	Manures per Acre	Produce per Acre			
		Dressed Corn			Straw, Chaff, &c.
		Weight	Number of Bushels	Weight per Bushel	
		lbs.		lbs.	cwts. qrs. lbs.
1	Unmanured	1,078	19·9	54·0	11 1 5
2	200 lbs. ammonia-salts, alone . . .	1,621	30·3	53·54	15 2 24
3	275 lbs. nitrate of soda, alone . . .	1,600	30·7	52·07	17 2 20
4	200 lbs. sulph. of potash, 100 lbs. sulph. of soda, 100 lbs. sulph. magnesia, $3\frac{1}{2}$ cwts. superphosphate of lime .	1,140	22·1	51·6	12 2 1
5	200 lbs. sulph. of potash, 100 lbs. sulph. of soda, 100 lbs. sulph. of magnesia, $3\frac{1}{2}$ cwts. superphosphate of lime, and 200 lbs. ammonia-salts . . .	1,782	33·5	53·12	19 3 6
6	200 lbs. sulph. of potash, 100 lbs. sulph. of soda, 100 lbs. sulph. of magnesia, $3\frac{1}{2}$ cwts. of superphosphate of lime, and 275 lbs. nitrate of soda . . .	2,353	43·8	53·75	25 2 18
7	Unmanured	1,082	20·3	53·15	10 2 20
8A	The same minerals as in 8B, and 400 lbs. ammonia-salts	2,346	43·0	54·55	23 2 20
8B	200 lbs. sulph. of potash, 100 lbs. sulph. of soda, 100 lbs. sulph. of magnesia, $3\frac{1}{2}$ cwts. of superphosphate of lime	1,628	29·6	55·08	15 3 20
9A	The same minerals as in 9B, and 550 lbs. of nitrate of soda	2,846	54·1	52·63	32 2 24
9B	200 lbs. sulph. of potash, 100 lbs. sulph. of soda, 100 lbs. sulph. of magnesia, $3\frac{1}{2}$ cwts. of superphosphate of lime	1,416	25·8	54·83	12 2 24
10A	No manure (having received manure as 10B in each of the five seasons previous to 1882, but none in 1882 or since)	1,368	25·3	54·08	14 0 22
10B	Farmyard-manure, estimated to contain nitrogen = 100 lbs. of ammonia, made from 672 lbs. decorticated cotton-cake, 1,075 lbs. maize-meal, 8,064 lbs. turnips, 1,344 lbs. wheat-straw chaff, as food; and 3,174 lbs. wheat-straw as litter. Weight about 4 tons	1,344	24·8	54·17	12 1 10
11A	No manure (having received manure as 11B in each of the five seasons previous to 1882, but none in 1882 or since)	1,942	35·5	54·75	18 2 18
11B	Farmyard-manure, estimated to contain nitrogen = 200 lbs. ammonia, made from 1,344 lbs. decorticated cotton-cake, 2,150 lbs. maize-meal, 16,128 lbs. turnips, 2,688 lbs. wheat-straw chaff, as food; and 6,348 lbs. wheat-straw as litter. Weight about 8 tons	1,776	32·3	55·06	17 0 14

year, the ten years' average being 23 bushels. Mineral manures alone gave 22·1 bushels; ammonia-salts alone, 30·3 bushels; and nitrate of soda alone, 30·7 bushels. The last two results are nearly identical, which is unlike what was noticed in the case of the wheat crop; both are, however, considerably below average. Ammonia-salts combined with mineral manures gave only 3 bushels per acre more, but nitrate of soda raised the produce by 13 bushels. These nitrogenous top-dressings, when used, as with the wheat, in double quantities, produced in either case 10 bushels more than when used in single amount; the yields were—with ammonia-salts and minerals, 43 bushels; with nitrate of soda and minerals, 54·1 bushels. This latter result is the only one which reaches the average of the ten former years.

Where nitrogenous manures, applied last in the spring of 1886, were omitted for a single year, the produce fell to 29·6 bushels in the case of ammonia-salts, and to 25·8 bushels in that of nitrate of soda, thus showing, as with the wheat, that there was more residue left from ammonia-salts than from nitrate of soda, and also that there is more residue of these nitrogenous top-dressings available for a subsequent barley than for a wheat crop, when each is grown continuously. The application of 4 tons and of 8 tons per acre of farmyard manure gave increases of 5 bushels and 12 bushels per acre respectively.

Reference is here directed to a summary by Sir J. B. Lawes of the continuous wheat and barley experiments during ten years, 1877–86, which appears in another part of the present number of the 'Journal.'

The Rotation Experiments.

It will be borne in mind that, on the conclusion of the second 4-course rotation in 1885, an alteration of the original plan was made, in consequence of decorticated cotton-cake not having shown itself superior as a manure to maize-meal similarly used. With the object of testing if this was due to any over-fertility of the land, and with the view of exhausting this, if existing, the four plots of each rotation were divided by a cross-path into eight plots of half an acre each. On four of these plots the rotation is continued as before, though the manurial treatment is not so heavy or so frequently repeated, while on the other four plots the same crops are grown in rotation without manure, and carried off the land entirely. In this way it is believed the true differences of manurial value may be brought out, and the question of over-fertility settled.

Rotation No. 1.—Four acres. 1885, tares (2 acres); peas (2 acres). 1886, wheat (4 acres). 1887, swedes (4 acres).

That the year was a disastrous one for root-growing will be readily admitted. It was with difficulty indeed that a plant could be obtained, and, as it was, the mangolds which were sown on April 28 on plots 5, 6, 7, and 8 without manure, and which it was intended to cart off entirely, never came up sufficiently to form a plant, and had eventually to be ploughed up and the land re-sown with swedes. Plots 1, 2, 3, and 4 were drilled on May 23 with 3 lbs. per acre of swede seed, 3 cwt. of superphosphate being sown broadcast before the drill. Despite the terribly dry weather, the plant was fair; it was set out on June 17. The re-sowing of plots 5, 6, 7, and 8 with swedes took place also on June 17, 3 cwt. of superphosphate being used as before. This fortunately came up by June 25. The want of rain was of course greatly felt, and later on the plant became badly mildewed. Of the two sets the later sown fared rather the better. The roots were pulled and weighed November 21–29, and the weights were:—

TABLE III.—PRODUCE OF SWEDES (ROTATION NO. 1) IN 1887.

PLOTS ½-Acre	Manures per Acre	Produce per Acre								Produce per Acre of Wheat in 1886
		Roots				Leaves				
		Tons	cwt.	qrs.	lbs.	Tons	cwt.	qrs.	lbs.	Bushels
1	3 cwt. superphosphate (after wheat—cotton-cake plot)	10	18	1	20	1	3	0	14	20·5
2	3 cwt. superphosphate (after wheat—maize-meal plot)	9	17	3	20	0	16	1	12	15·5
3	3 cwt. superphosphate (after wheat with artificial equivalent of cotton-cake dung)	11	0	0	4	1	4	2	20	20·3
4	3 cwt. superphosphate (after wheat with artificial equivalent of maize-meal dung)	8	19	3	8	0	19	2	4	15·1
5	3 cwt. superphosphate (after wheat—cotton-cake plot)	10	14	0	8	1	8	0	22	25·15
6	3 cwt. superphosphate (after wheat—maize-meal plot)	9	17	1	12	0	18	1	8	23·4
7	3 cwt. superphosphate (after wheat with artificial equivalent of cotton-cake dung)	9	14	1	4	0	17	2	0	24·8
8	3 cwt. superphosphate (after wheat with artificial equivalent of maize-meal dung)	8	8	3	14	0	17	2	16	24·8

It may be remembered that the crop of 1885 (tares and

peas) failed, and too much reliance must not be placed on the wheat results of 1886, owing to the uneven plant. Still, taking together the root crop of 1887 and the previous wheat crop of 1886, it is clear that the cotton-cake plots produced higher results than the maize plots. For instance, plot 1 (cotton-cake) has yielded 20½ bushels of wheat and 11 tons of swedes, against 15½ bushels of wheat and 10 tons of swedes in the case of plot 2 (maize-meal). Similar differences are observable in the case of the other plots, the cotton-cake plots always coming out the better. The fact that between the upper half of the field (plots 1, 2, 3, and 4) and the lower (plots 5, 6, 7, and 8) there was practically no difference in the swede crop, is not to be wondered at, inasmuch as the tares and peas both failed in 1885, and, no manure being applied to the wheat in 1886, the treatment of both halves was thus practically alike.

Rotation No. 2.—Four acres. 1885, swedes (2 acres), mangolds (2 acres); 1886, barley (4 acres); 1887, tares (2 acres), peas (2 acres). The peas (Sangster's White, No. 1) were drilled on plots 5, 6, 7, and 8, on March 5, 1887, at the rate of 2 bushels per acre; and the tares in the same quantity on plots 1, 2, 3, and 4, on March 10, both without manure. The peas were cut and harvested July 23–30, and the tares the first week in August. Both lots were thrashed October 18–28; the results are given in Tables IV. and V. below.

The crops were not nearly as heavy as those of 1886. It may be remembered that it was on this rotation, in the case of the barley of 1886, that the first indication of the high yield due to cotton-cake as against maize-meal was observable; and here to

TABLE IV.—PRODUCE OF TARES (ROTATION NO. 2) IN 1887.

Plots ½-Acre	Manures per Acre	Produce per Acre							
		Weight			Number of Bushels	Weight per Bushel	Straw, &c.		
		cwt.	qrs.	lbs.		lbs.	cwt.	qrs.	lbs.
1	No manure (after barley—cotton-cake plot) . . .	11	3	22	20·9	63·85	19	2	9½
2	No manure (after barley—maize-meal plot) . . .	11	2	5½	20·1	64·52	15	3	25½
3	No manure (after barley with 124 lbs. nitrate of soda, artificial equivalent of cotton-cake dung)	10	0	1	17·2	65·06	14	0	26
4	No manure (after barley with no manure, artificial equivalent of maize-meal dung)	9	0	9	15·8	64·21	13	0	5

TABLE V.—PRODUCE OF PEAS (ROTATION NO. 2) IN 1887.

Plots ½-Acre	Manures per Acre	Produce per acre								
		Weight			Number of Bushels	Weight per Bushel	Straw, &c.		
		cwt.	qrs.	lbs.		lbs.	cwt.	qrs.	lbs.
5	No manure (after barley—cotton-cake plot) . . .	20	0	0	34·6	64·8	17	1	3
6	No manure (after barley—maize-meal plot) . . .	17	1	7	29·8	65·07	14	1	3
7	No manure (after barley with 124 lbs. nitrate of soda—artificial equivalent of cotton-cake dung)	13	3	16½	24·2	64·31	13	1	4½
8	No manure (after barley with no manure—artificial equivalent of maize-meal dung)	9	1	0	16·1	64·44	15	3	11

some extent this is continued. Still, tares and peas are at best uncertain crops, and were only sown because clover, owing to the alteration of the plan of the experiments, had not been sown with the barley. The evidence of unexhausted fertility is strong when it is remembered that the plots 5, 6, 7, 8 produced in 1885 11 tons of mangolds, which were carted off entirely; then, without further manure, 35 bushels of barley; and now (still without manure) 30 bushels of peas.

Rotation No. 3.—Four acres. 1886, tares (2 acres), peas (2 acres); 1887, wheat.

The tares and peas were both reaped in 1886, and the succeeding wheat (8 pecks of Browick wheat per acre) was drilled on Oct. 23. It ripened well, though towards the close it was badly attacked by the Hessian fly. It was cut and stacked Aug. 11–13, 1887. On account of the attack by Hessian fly the stubble was cut quite 9 inches high, which accounts for the very small yield of straw recorded.—(See Table VI. opposite.)

Rotation No. 4.—Four acres. 1886, swedes (2 acres), mangolds (2 acres); 1887, barley.

The swedes on the one half of the rotation had been grown in 1886 with 3 cwt. mineral superphosphate per acre, the produce being:—

Plots	Manures	Produce of Swedes per Acre in 1886			
		tons	cwt.	qrs.	lbs.
1	Cotton-cake plot	4	13	3	20
2	Maize-meal plot	8	15	2	4
3	Artificial equivalent of cotton-cake dung . . .	7	15	2	20
4	Artificial equivalent of maize-meal dung . . .	7	9	1	16

TABLE VI.—PRODUCE OF WHEAT (ROTATION NO. 3), IN 1887, AFTER (a) TARES, (b) PEAS.

Plots ½-Acre	Manures per Acre	Produce per Acre—Dressed Corn										Straw, Chaff, &c. per Acre		
		Head-corn					Tail-corn							
		Weight			Bushels	Weight per Bushel	Weight			Bushels	Weight per Bushel			
		cwt.	qrs.	lbs.		lbs.	cwt.	qrs.	lbs.		lbs.	cwt.	qrs.	lbs.
1	No manure (after tares—cotton-cake plot)	19	3	2	39·8	55·57	1	0	23½	3·1	44·25	28	0	19½
2	No manure (after tares—maize-meal plot)	17	3	23½	35·7	56·28	0	3	25	2·2	48·50	24	0	20½
3	No manure (after tares—artificial equivalent of cotton-cake dung)	15	0	21	30·1	56·43	1	3	2	4·1	48·75	25	0	27½
4	No manure (after tares—artificial equivalent of maize-meal dung)	15	3	2	30·4	58·07	1	0	20	2·75	48·0	24	2	21½
5	No manure (after peas—cotton-cake plot)	16	1	22½	30·3	60·75	1	0	5	2·2	53·0	23	0	23
6	No manure (after peas—maize-meal plot)	16	1	23½	30·6	60·22	1	0	21½	2·5	52·0	23	3	19
7	No manure (after peas—artificial equivalent of cotton-cake dung)	18	0	17	34·4	59·10	1	0	22	2·6	51·5	27	3	1½
8	No manure (after peas—artificial equivalent of maize-meal dung)	18	0	26	36·1	56·50	1	0	17½	2·8	46·25	29	0	6½

TABLE VII.—PRODUCE OF BARLEY (ROTATION NO. 4), IN 1887, AFTER (*a*) SWEDES FED ON THE LAND, (*b*) MANGOLDS CARTED OFF.

Plots ½-Acre	Manure per Acre	Produce per Acre—Dressed Corn										Straw, Chaff, &c. per Acre		
		Head-corn					Tail-corn							
		Weight			Bushels	Weight per Bushel	Weight			Bushels	Weight per Bushel			
		cwt.	qrs.	lbs.		lbs.	cwt.	qrs.	lbs.		lbs.	cwt.	qrs.	lbs.
1	After Swedes fed-off with cotton-cake	20	2	2½	41·4	55·47	1	2	11½	3·8	49·0	28	2	20
2	After Swedes fed-off with maize-meal	19	3	1	40·2	55·07	1	1	22	3·3	48·5	32	1	19½
3	After Swedes fed-off, and artificial equivalent of cotton-cake dung	22	3	7	46·6	54·80	1	1	25	3·4	49·0	37	1	22
4	After Swedes fed-off, and artificial equivalent of maize-meal dung	21	2	20	44·2	54·9	1	0	24½	2·9	46·5	34	0	13½
5	No manure (after mangolds carted off—cotton-cake plot)	10	2	26	20·9	55·12	2	2	10	5·9	49·5	16	1	23½
6	No manure (after mangolds carted off—maize-meal plot)	12	2	27	25·7	55·62	1	0	23	2·7	49·5	17	3	15
7	No manure (after mangolds carted off—artificial equivalent of cotton-cake dung)	15	2	3½	31·1	55·98	0	3	17	2·0	50·5	20	0	23½
8	No manure (after mangolds carted off—artificial equivalent of maize-meal dung)	14	3	5	29·7	55·87	1	0	26½	2·8	48·75	19	3	8½

The root crop being so small, the whole of it was fed off by sheep, with additional foods as follows:—

Plot 1 (half-acre) . .	with 200 lbs. decorticated cotton-cake
„ 2 „ . . .	„ 200 lbs. maize-meal
„ 3 „ . . .	„ no purchased food
„ 4 „ . . .	„ „ „ „

A little wheat-straw chaff (70 lbs. per ½ acre) was also given to the sheep. On plots 3 and 4, artificial equivalents of the cotton-cake and maize-meal dung respectively were applied to the succeeding barley. The sheep were put on the roots Dec. 2, 1886, and finished them by Dec. 31. After ploughing, barley (8 pecks of "Golden Melon" per acre) was drilled on March 24, 1887, over the whole rotation. The nitrogenous manures were sown on plots 3 and 4 on May 10.

On the lower half of the rotation, mangolds had been grown in 1886, the produce being:—

Plots	Manure	Produce of Mangolds per Acre in 1886			
		tons	cwt.	qrs.	lbs.
5	Cotton-cake plot	17	8	1	2
6	Maize-meal plot	19	1	1	20
7	Artificial equivalent of cotton-cake dung . .	19	18	3	14
8	Artificial equivalent of maize-meal dung . .	18	13	2	14

These were carted off entirely. The barley (of 1887) did not make much progress at first owing to the continued cold, but came up fairly well, and was cut and harvested Aug. 12–16. The results are given in Table VII. on p. 286.

From these figures it will be seen how striking was the difference when even such a small crop of swedes had been fed off by sheep, and when mangolds, 10 to 16 tons per acre, were carted off entirely. The top-dressings of nitrate of soda on plots 3 and 4 would appear to have been rather more effectual than the dung; the difference between the cotton-cake and the maize-meal, though indicated, is not very pronounced.

Experiments on the Comparative Manurial Values of Decorticated Cotton-cake and Maize-meal, conducted in Lansome Field.

1885, barley; 1886, broad clover; 1887, wheat. On October 16, 1886, 9 pecks per acre of Essex rough-chaff wheat were dibbled, this variety being tried for a change of seed. It is worthy of remark that, while the red wheat sown on all the other fields suffered from the Hessian fly attack, this white

TABLE VIII.—PRODUCE OF WHEAT IN LANSOME FIELD IN 1887 AFTER BARLEY.

Plots ⅛-Acre	Manures used per Acre for Barley in 1885	Produce per Acre—Dressed Corn: Head-corn: Weight			Head-corn: Bushels	Head-corn: Weight per Bushel	Tail-corn: Weight			Tail-corn: Bushels	Tail-corn: Weight per Bushel	Straw, Chaff, &c. per Acre		
		cwt.	qrs.	lbs.		lbs.	cwt.	qrs.	lbs.		lbs.	cwt.	qrs.	lbs.
1	No manure	12	2	8	22·37	62·95	2	1	1	4·16	60·75	27	1	20
2	With dung made from 9 cwt. decorticated cotton-cake, 120 cwt. white turnips, 20 cwt. wheat-straw chaff, and 48 cwt. wheat-straw as litter; weight about 4 tons . .	13	3	24	24·64	63·46	2	3	20	5·33	61·5	27	3	9
3	With decorticated cotton-cake meal, pulped roots and wheat-straw chaff, containing the same amount of manurial constituents as the dung in No. 2, but applied direct to the land	15	3	15	27·93	63·71	3	1	8	6·0	62·0	32	0	10
4	No manure	17	0	2	29·95	63·64	2	2	1	4·61	61·0	31	0	9
5	With dung made from 9 cwt. maize-meal, 120 cwt. white turnips, 20 cwt. wheat-straw chaff, and 48 cwt. wheat-straw as litter; weight about 4 tons	15	0	13	26·63	63·58	2	3	21	5·35	61·5	30	0	12
6	With maize-meal, pulped roots, and wheat-straw chaff, containing the same amount of manurial constituents as the dung in No. 5, but applied direct to the land . .	14	2	16	26·03	63·03	2	3	14	5·15	62·5	31	2	1

wheat was not affected at all. The crop was cut and harvested July 29–August 5, 1887; the results are given in Table VIII.

The duplicate unmanured plots show considerable difference, but taking the mean of them we find that for the third consecutive year the highest result has been obtained by the decorticated cotton-meal used direct as manure (plot 3), while on this plot the most straw also has been produced. It is probable that plot 1 more truly represents the unmanured produce, but the entire crop was but a poor one on this land.

Crawley Mill Farm is situated near Woburn, Bedfordshire; the soil is a very light reddish loam, about nine inches deep, with a subsoil of almost pure sand.

RAINFALL AT WOBURN DURING 1887, TAKEN AT 8 A.M. DAILY AT CRAWLEY MILL FARM.

	Inches		Inches
January	1·79	July	0·64
February	0·41	August	0·85
March	1·05	September	1·77
April	1·33	October	0·96
May	1·30	November	2·19
June	1·69	December	1·06
		Total rainfall in year	15·04

RAINFALL IN 1882, 1883, 1884, 1885, 1886, AND 1887.

—	1882	1883	1884	1885	1886	1887
Inches	28·14	24·20	17·84	24·97	25·05	15·04

DURING THE HARVEST MONTHS OF AUGUST AND SEPTEMBER THE RAINFALL WAS—

—	1883	1884	1885	1886	1887
Inches	4·65	2·76	6·65	2 61	2·62

XV.—*Annual Report for* 1887 *of the Consulting Entomologist.* By ELEANOR A. ORMEROD, F.R.Met.Soc., Torrington House, St. Albans.

DURING the twelve months since I rendered my preceding annual Report, there have been constant applications regarding injurious insects. These have chiefly been regarding the attacks of the Hessian fly, the corn saw-fly, and also the ribbon-footed

corn-fly to corn stems; the attacks of eel-worms to oats and clover; and, likewise, there has been a very large amount of correspondence, and very satisfactory communication, regarding ox warble-fly, showing the great benefit arising from destruction of the maggots.

Amongst the corn attacks, that of the Hessian fly has been reported by the largest number of observers, although in the individual instances (as far as reports to myself show) it has not been as serious in its damages as the *Chlorops tæniopus*, the ribbon-footed corn-fly, which has long been here.

In my report on Hessian fly made to the Council in November, I mentioned that four kinds of the British parasites which I had forwarded to Moscow to the inspection of Dr. Lindeman had been found by him to be Russian species. I have since been in communication with Professor Riley, Entomologist to the Department of Agriculture of the United States, during his stay in England, and he still further confirms the fact of our British parasites being Russian forms. Professor Riley's opinion is of great value from his personal knowledge of the subject. After two days' investigation of specimens reared from British puparia, together with Russian specimens forwarded to him by Dr. Lindeman, he has placed in my hands a short account of the result of the examination, and I submit a list of the scientific names of these British parasites.

They are as follows:—1. *Platygaster minutus*; 2. *Semiotellus nigripes*; 3. *Eupelmus Karschii*; 4. *Merisus intermedius*; 5. *Tetrastichus Rileyi*; 6. *Euryscapus saltator*, all species of Lindeman, and 7. *Dacnusa senilis*, Hald.

This result of the investigations of Professors Lindeman and Riley puts an end up to the present date to any reason for supposing that the Hessian fly attack has been brought to us from America. The parasites above mentioned are excessively minute four-winged flies, which can only be certainly identified by comparison of specimens, as there are not full descriptions or figures attainable. Probably two, if not three, of the kinds will be found to be similar to (or to minutely resemble) British kinds previously known here; but this point will be further investigated.

The examinations as to presence of flax-seeds in imported straw have still been continued at Hull by Mr. Edmund Riley, more especially with reference to the very large imports of eggs from Russia. As some of these come over in straw of rye, which is one of the corn crops liable to infestation, mischief might be feared, but I am informed by Mr. E. Riley, who is investigating on my behalf (and is perfectly qualified for an examiner), that the straw is mostly cut above the second joint. I have myself

had a sample sent, showing that the straw was so bruised to shreds to make it soft for packing material that it appeared hardly possible it could have flax-seeds adhering to any of it; further, I have obtained information, through one of the largest egg importers, that the straw used for packing eggs from the Russian districts whence the eggs are long in transit, has to be artificially dried. This is done by placing it in heated rooms in racks, which would very effectually kill the chrysalids.

As the watch on straw has now been going on since the spring of the year, and in all the straw and sweepings from different countries searched by many different observers (though quantities of things resembling "flax-seeds" at first sight have been sent me for identification), we have only found one single puparium, I think we may now discontinue the work.

From last season's experience, there does not seem to be any reason to anticipate serious damage from Hessian fly, excepting what may occur, more or less, to barley. The point which is of the greatest importance now, as a measure of prevention, is the complete destruction of the "flax-seeds" which are found in the fine siftings and rubbish beneath the thrashing machines. If this is not done, each centre of neglect will be a centre of infestation to the neighbourhood.

Many communications were sent to me regarding Chlorops' attack on barley. This occurred (speaking generally) in much the same districts of England that were affected by Hessian fly, and were often not distinguished from it. Very little about it was reported to me from Scotland, and two of the worst attacks were in the south of England. In the samples of one of these, the ears had not freed themselves from their sheaths, and the plants were stunted down to only about seven to nine inches high; in the other the ears in some instances were hardly freed, and the stem between the highest knot and the ear only about an inch and a half or two inches long. The direct injury from the gnawing of this corn-fly maggot extended half way up the ear.

The reports agreed in great amount of damage being done —usually stated (generally) as very "serious," "considerable," and so on. But the only precise estimates sent were of loss of one-third of the crop, and of one bushel an acre. From the samples forwarded, I have no hesitation in considering the damage to have been of a most unusual amount, which I believe to have been owing to the unusual heat and drought of the past season.

This attack has long been known in England, and it is on record with localities given that in 1846 from half to two-thirds

of the barley crop was destroyed by it at various places in the east of England.

The injury is caused by this corn-fly—the *Chlorops tæniopus* (which is a stumpy-made, two-winged fly, black and yellow in colour, and only about one-eighth of an inch long)—laying its egg on or near the lowest part of the ear, and the maggot which hatches out gnawing a channel down one side of the stem to the uppermost knot. This blackened furrow, and the ear often injured at the lowest part, and frequently unable to free itself from its sheath, are the special signs of Chlorops' attack.

Various recipes are given for checking this attack, but I believe that a healthy growth where the plant is neither gorged by damp in the water furrows, nor dried and unmanured on bad ground, where I have specially seen it, is the best method of preventing loss from it. But judging by records and my own experience for fifteen years or more, I know no reason to expect a recurrence of this, which has been our worst corn attack of the last season, unless we have again a season of exceptional heat and drought.

Corn saw-fly attack (that of the *Cephus pygmæus*) was also unusually observed last season, and was certainly very injurious in some localities, though not nearly as much reported to me as Chlorops. This saw-fly is a small black-and-yellow, four-winged, and somewhat wasp-like fly, and does harm by its maggot feeding within the corn stalks, travelling up through the knots, and then down again, and ending by biting the stem nearly through in a ring just about ground level when the corn is nearly ripe. As a matter of course, the stem falls easily, and in common circumstances may pass as storm-broken, but in last year's alarms the fallen straw attracted unusual attention.

This attack, like that of Chlorops, has long been here. I have had personal knowledge of it myself as long as about eighteen years ago; it has been recorded as abundant as far back as the year 1835, and though widely distributed on the Continent of Europe, I am not aware of it being recorded amongst the injurious insects of America. I mention the above points in consequence of great alarm having been expressed as to this being a new attack now being imported from America.

As the maggot goes into chrysalis at or below ground level, in the stump which it has itself sawn the top off, there is not the slightest fear of it being imported in either seeds of any kind or straw, and any recurrence of last season's attack from the chrysalids now in the stumps may be easily and surely prevented by skimming and dragging the roots and stubble, or collecting

them in any way preferred, and burning them. As the saw-fly does not come out until early summer, attack is thus easily checked.

A rather serious attack affecting various kinds of corn, but with us more especially affecting autumn-sown wheat, has been reported for some years, and with the help of Mr. Meade, of Bradford, I have traced this from specimens reared by myself to the frit fly—the *Oscinis frit*—a small two-winged fly, of which the maggot feeds within the young shoot, and sometimes much harm is done thereby in spring, unless there are sufficient unattacked shoots to carry on growth. As this attack cannot be caused by anything else than the autumn brood of frit flies laying their eggs on the plants, I should advise that, in infested districts, the sowing should be as late as possible, so that the flies might be dead before the wheat sprung.

Other corn attacks, as of moth caterpillars, to the ears, or stacked with the straw; likewise of granary beetles, and especially of granary weevils, have been reported; but it is worth notice that the *Cecidomyia tritici*, the British wheat midge, producing the well-known "red maggot," and corn aphides, have been very little reported.

I have given particular attention to the *Anguillulæ*, or eel-worms, which last year I reported as having been found to cause tulip-root in oats, and which it appeared likely would be found to cause the special form of disease in clover known as "clover sickness." For several months I procured specimens of diseased plants, and examined them myself to the best of my ability, and also forwarded samples to the Netherlands to the skilled examination of Dr. J. G. de Man, of Middleburg, and Dr. J. Ritzema Bos, Professsor of Zoology at the Royal Agricultural College, Wageningen.

The result has been that we found that in plants affected by the true "clover sickness" there was presence in all its stages of the same kind of eel-worm—namely, the *Tylenchus devastatrix*, Kuhn, which causes the "tulip-root" disease in oats; the disease known as "stem sickness" in rye, and also attacks other plants too numerous to mention. This eel-worm was present in the truly clover-sick plants, in all conditions and stages—male, female, larvæ, and eggs.

The proof of the kind of Tylenchus being the same in all the attacked plants has been given by Dr. Ritzema Bos, showing that they would take the infestation from each other. Onions (which are liable to this disease) when sown by him on earth mixed respectively with "clover-sick" plants, "tulip-rooted" oats, &c., were found to become infested by the Tylenchi; and, reversing the order of the experiment, oats sown by him on

earth containing "clover-sick" plants, and also on diseased onions, were found to become "tulip-rooted."

The investigation showed that clover suffered from various causes, and notably from fungi, and various kinds of eel-worms were present in decayed stems, &c., but where specimens of true "clover-sick" plants were sent, there were the Tylenchi in such numbers and conditions as to point them out as the cause of the disease; and also in the most severe and well-marked attack the shoots or buds along the main clover shoots had the same kind of swollen and stunted appearance that we find in other cases of Tylenchus attack.

The only note sent in this year of an entirely successful application to the diseased clover was top-dressing with a mixture of sulphate of potash in large proportion, together with sulphate of ammonia and steamed bone-flour. This brought on the crop very satisfactorily. The history and habits of this microscopic eel-worm have been gone into before, but a broad view of this case appears to be that oats, clover, and onions are the most liable of our common crops to this attack. The Tylenchi likewise infest some of our common weeds, and can remain for a great length of time alive in the surface soil of infested fields. Therefore deep ploughing, which will put the minute worm too far down for it to come up again, is a very desirable measure.

Inquiries were also forwarded regarding such common crop pests as wireworms, "rust," *i.e.* fly maggot attack to carrots, cabbage butterfly, caterpillars, &c., &c., and also regarding turnip grub (the caterpillar of the Turnip or Dart moth, the *Agrotis segetum*), which has done great mischief to turnip bulbs in many places during the autumn, and is very likely still at work where the weather is not too severe. From the circumstance of this caterpillar living through the winter, it is very desirable to skim and stir the surface of fields that have been badly infested, for if the caterpillars are thrown out of their shelters they will be killed by bad weather, though mere cold would not hurt them in their shelters in the ground. "Blight," as it is called, that is, attack of aphides on turnips, has been very bad, but there does not appear to be a hope of checking this attack until some plan can be arranged for washing, as with aphides on hops.

Amongst insects injurious in fruit-farming the grubs of the Pear Saw-fly, and likewise the *Phytoptus* (a small mite which causes a gall growth of the leafbuds of black currants), were troublesome, but both these attacks can be easily kept in hand, and the extremely simple method of preventing attack of the winter moth caterpillars in spring by smearing bands round

orchard trees so that the wingless moths cannot get up them to lay eggs *now*, is being well carried out, and found to answer. This is important to fruit-farmers, for the caterpillars are excessively destructive. Various other crop and fruit attacks were reported, to all which I gave requisite attention.

In regard to cattle insects, the attention paid to warble attack has been highly beneficial. About twenty-two thousand copies of the leaflet on "Ox Warble" have been distributed, and the simple measures recommended are reported by very large numbers of cattle-owners to answer excellently, both in destroying the maggot, and (consequently on this maggot not being allowed to develop into a fly) in preventing much of the galloping from warble-fly attack in summer. We are really at last undermining the idea that dozens of maggots an inch long feeding in the hides of the cattle are only a sign of health. Communications have also been sent in about the ox gad-fly (*Tabanus bovinus*) and also the horse warble-fly, and one or more kinds of horse bot-fly (*Gasterophilus*); but as the latter attack is a regular subject for veterinary treatment, I have merely given such points of the history of the insect as were requisite to my correspondents.

Specimens have also been sent me of the sheep's-nostril maggot, the larva of the fly known as the *Cephalemyia ovis*. These had been taken from the head of a sheep badly affected with the disease known as the "gids," and were considered by the sender to have been taken out of the brain. As it is a not uncommon belief (even to the extent of affecting the sale of sheep's heads at the season when the maggot is to be found) that it harbours in the brain, and also as it is quite possible that the maggots in their earliest stages could make their way through minute orifices into the brain, I have carefully investigated the matter.

The head of another sheep from the same flock, suffering under the same symptoms, was sent me, and opened surgically, and not a trace of maggot presence was found; but it showed severe presence of the well-known hydatid attack, producing the various symptoms known as "gid" or the "giddies." Other heads were brought, showing this attack in the brain, or maggots high up in the nostrils, and the two attacks might occur together; but there was nothing to give any reason to suppose that the maggots existed and grew to maturity in the brain. I think it is worth while to maintain this, as the possibility has been brought forward on somewhat high authority.

The general work in my department continues steadily to increase. In the preceding year (1886) the number of letters written by myself in reply to inquiries on subjects directly con-

nected with injurious insect matters, or requisite coincident correspondence, was approximately eleven hundred. In the year 1887 it was more than fourteen hundred. Much of the increase turned on correspondence regarding warble attack, Hessian fly and other corn-straw attacks, and crop eel-worms.

Besides British correspondents, I have had much communication with leading entomologists in our own colonies, also in the United States and in various European countries, and I wish to acknowledge with thanks the very serviceable and courteous assistance which they have invariably afforded in any points of difficulty.

XVI.—*Annual Report for 1887 of the Consulting Botanist.* By W. Carruthers, F.R.S., P.L.S., 44 Central Hill, Norwood, S.E.

During the past year I have attended to 341 applications from members of the society, referring mainly to seeds for permanent pasture. The general result of my examination of pasture seeds testifies to the continued maintenance of their improved quality; there is, however, evidence to show that a large quantity of utterly bad seed finds its way into the hands of the farmers. Thus, in seeds bought from seven merchants in the east of England, the white clovers contained 10 per cent. or more of weeds, and the red clovers and alsikes had seeds of dodder besides other weeds. The timothy was ergotted, the cocksfoot was very impure, one sample containing no less than 34 per cent. of other and worthless seeds; and even the rye-grass was made the vehicle of spreading Yorkshire fog on the land, one sample containing 12 and another 15 per cent. of this grass, which is never eaten by stock unless under the greatest necessity. In some cases of these seeds, the germination was very low. Trefoil germinated in one case only 36 per cent., and in another not more than 20 per cent., red clover 34 per cent., white clover 47 per cent., and cocksfoot 41 and 43 per cent. The committee wished to publish the names of the firms which had supplied these seeds, but the member of the society on whose behalf the examination was made objected, and failed to give the information necessary to justify the taking of this step.

During the past year I have met with only a single case of meadow-fescue which contained ryegrass in such quantity as to show that it had been introduced for the purpose of adulteration; there was 20 per cent. of ryegrass in the sample. Indeed, it would seem as if the ryegrass had been in some quarters a scarce commodity, for a sample of pure and good meadow-fescue

was supplied to a member as ryegrass, and charged, I suppose, the price of ryegrass. The germination of the meadow-fescue was high, the average showing nearly 96 per cent., and in no less than 12 per cent. of the samples every seed placed in the germinating case produced a plant. One sample of tall fescue contained 12 per cent. of ryegrass, but the other samples were entirely free from it. The average germination of this species was 74 per cent.

Cocksfoot has been somewhat impure, as much as 20 per cent. having contained considerable quantities of Yorkshire fog. The germination averaged 76 per cent., but one sample contained only 6 per cent. of living seeds. It consisted almost entirely of empty husks, and was apparently the chaff from which "shelled" seeds had been obtained. It must have been placed in the market in the first instance as a deliberate fraud, and though the member who purchased it satisfied himself that the merchant from whom he had it was innocent, it is impossible for me to understand how any merchant could have passed such a sample through his hands without detecting that it was only chaff. It shows that much has yet to be done before all the members of the seed trade are intelligently acquainted with what they are dealing in.

The smaller fescues were free from weeds, and their germination was satisfactory. It is not easy to get true sheep's-fescue, the smaller seeds of hard fescue being frequently sold for that grass. But the small fescues—*fine grasses*, as they are often called—are of little value in pasture, their slender wiry leaves affording little food; and hard fescue is on the whole the better of the two. Timothy, with the exception of the ergotted sample referred to, was throughout good, and the average germination was no less than 97 per cent. Meadow-foxtail often contains a large proportion of *Aira cæspitosa*. The germination of foxtail is very irregular. The average of the samples examined during the past year was 62 per cent.; the highest sample reached 88 per cent., and the lowest fell to 33 per cent.

Of the meadow-grasses, *Poa trivialis*, or rough-stalked meadow-grass, was of the best quality. The seeds were pure, the germination averaging 79 per cent. This is important, as this species is certainly the best of the meadow-grasses. Three samples of *Poa pratensis* yielded only one, four, and fifteen plants to the 100 seeds, and the same number of samples of *Poa nemoralis* germinated only 12, 15, and 16 per cent. These were sent to me along with good samples of *Poa trivialis*, and were probably obtained from the same merchants. The seeds of the Poas early lose their vitality, and those that are carried over even for a single year become very greatly deteriorated,

They should not be used, or, if used, it should be in such largely increased quantity as to make up for the loss of vitality. Sweet vernal grass gave only a little over 50 per cent. of germination in the average. One sample had a considerable mixture of the annual vernal grass (*Anthoxanthum puellii*), and another had a large quantity of the minute seeds of the Wood Rush (*Luzula campestris*). Only one sample of fiorin was free from ergot. Considering the questionable value of this grass, it seems to me more than doubtful whether a farmer is not paying too great a price for it when he almost certainly introduces with it the dangerous ergot into his pasture.

The clovers have been more impure than usual. Over a half of the white clovers contained an appreciable quantity of weeds, and in some the quantity was considerable. In the red clovers 40 per cent., and in alsikes 20 per cent., contained impurities, and in most of these the seeds of dodder were among the impurities. This dangerous weed, being smaller than the clover seeds, could easily be separated from them by a cleaning-machine; but, unhappily, not a few seed-merchants do not know the seeds of dodder, and, consequently, they ignorantly distribute the unclean seed. Some even deny that the dodder can be detected in the clover seed. It is not met with among the seeds of white clover, but is too frequent in alsike and red clover. Last summer a member lost a considerable quantity of spring tares from dodder appearing and rapidly developing on them. The loss was the greater because of the want of food during a dry summer. The germination of the clovers has been satisfactory; there has, however, been a considerable range in their vitality. In some extremely good samples of red clover every seed germinated, but one fell so low as 34 per cent., while in alsike the best germinated 98 per cent., and the worst was not more than 30 per cent., that is to say, three pounds of the poorer seed in these two clovers would be required to produce the same number of plants as would grow from one pound of the better samples, though possibly the price per pound of each was the same.

Having been informed by Mr. De Laune that Mr. Moore, of the Royal Botanic Gardens, Glasnevin, Dublin, had been growing for some years an experimental plot of the true cowgrass (*Trifolium medium*), I applied to Mr. Moore with the view of procuring some of the seed. He has been so good as to send me a small quantity, which I propose to sow at Woburn alongside of the experimental clover plots. This is a truly perennial plant, and is the only red clover specially fitted for permanent pasture. The plant has a zigzag stem, taking an obviously different direction at each leaf, and the round head of flowers is borne on a short, leafless stalk. The two species can be easily

determined when in seed, as in the red clover (*Trifolium pratense*) there is a single seed in the pear-shaped pod, and the pod opens by the top falling off, while in cowgrass (*Trifolium medium*) there are two seeds in the oblong pod, and the pod opens along the edges like the pod of a pea. The seed also is more heart-shaped than in the red clover. Sinclair recognised the importance of cowgrass sixty years ago, but he found it hard then to purchase the seed—now it is impossible. All the seeds now sold under the name of cowgrass belong to varieties of red clover, and these differ among themselves just as the varieties of cultivated wheat differ. I have reason to hope that the true cowgrass may be soon available to the farmer.

Different estimates are formed of the germinating value of mangold seeds. They are obtained from the seed-merchant, not as separate seeds like clover or turnip, but enclosed in a compound fruit, each containing two or three seeds covered by the enlarged fleshy base of the calyx of so many flowers. Each fruit should consequently produce two or three plants. These plants when they grow are, however, produced so close together that they are of no practical use to the cultivator, and have to be carefully thinned out. In testing the mangold seed I have determined whether each compound fruit would produce a plant; others have taken each seed that germinated into account, and consequently record good mangold "seed" as growing—say, 180 per cent. This, of course, means that of the seeds in 100 compound fruits, amounting in all to 200 or 250, 180 have grown. As the farmer must, however, consider each compound fruit as if it were a single seed, it seems the only fair way to test it from that point of view, and so to determine how far each "seed" supplied by the merchant is available to produce a plant.

XVII.—*Annual Report for* 1887 *of the Consulting Chemist.*

By Dr. J. AUGUSTUS VOELCKER, B.A., B.Sc., 12 Hanover Square, W.

THE number of samples analysed in the Society's laboratory during the past year was, in all, 1,615; of these 1,536 were analyses made for members of the Society, 56 were in connection with the Woburn experiments, and 23 analyses on behalf of local Agricultural Societies carrying out experiments in conjunction with this Society. At the end of this Report is given a list of the different kinds of analyses, and their number.

Of the 1,615 samples analysed, nearly 700 have been of feeding-cakes. By far the larger proportion consisted of linseed-

cakes; indeed, the chief feature of the analytical work of the year has been that performed in connection with linseed-cakes, their adulterants, and the methods of detecting and estimating the same. It is hardly too much to say that the practice of mixing foreign seeds and other materials with linseed, previous to pressing it into cake, reached its climax in 1887. The Royal Agricultural Society has for a long time contended for the purity of feeding materials, and the increase of adulteration has led to renewed activity on its part, as is evidenced by the Quarterly Reports of the Chemical Committee in the present number of the 'Journal.'

During the year I took an opportunity kindly offered me of inquiring personally into the manufacture of linseed-cakes more or less impure. One of the chief points that forcibly impressed itself upon me was the impossibility of judging from the figures of analysis alone whether a linseed-cake were a pure one or not, and the necessity of a special microscopical examination in all doubtful cases. This is a practice which I am glad to find has since been taken up by other chemists, as the necessity has become more and more apparent. Of the materials used to adulterate linseed-cakes, the one now most frequently occurring is *rape refuse*, or rape seed from which the oil has been extracted by chemical means. The following table gives analyses of linseed-cake made from pure seed, and of other cakes made from the same seed after admixture with different percentages of the aforesaid rape refuse:—

	Pure linseed cake	Linseed cake with 5 % rape refuse	Linseed cake with 10 % rape refuse	Linseed cake with 30 % rape refuse
Moisture	10·29	12·28	10·97	11·32
Oil	12·66	11·33	10·53	10·60
[1] Albuminous compounds (flesh-forming matters)	28·59	29·57	28·93	30·87
Mucilage, digestible fibre, &c.	34·85	32·37	35·19	31·07
Woody fibre	8·07	8·81	8·80	10·16
[2] Mineral matter (ash)	5·54	5·64	5·58	5·98
	100·00	100·00	100·00	100·00
[1] Containing nitrogen	4·57	4·73	4·62	4·94
[2] Including sand	·59	·80	·59	1·09

Taking these figures, there is not one single constituent that could be pointed out as indicating the least suspicion of the cake being impure. The sand is not high in any of them, nor the woody fibre exceptional. In the mixtures containing 5 and 10 per cent. respectively, there is but little more of either than

in the pure linseed-cake, and even where 30 per cent. of the adulterant is added, there is not more than frequently occurs with pure cakes. Nothing in short is to be gathered from the figures alone so far as this particular adulterant is concerned.

The result of my inquiry and a careful examination of all the points involved led me to suggest that the following should be the requirements which a linseed-cake should satisfy in order to be fairly termed a pure one :—

1. That it be made from sound seed of not less than 95 per cent. purity, subsequently well screened.
2. That it contain no ingredients of a poisonous or deleterious nature.
3. That it be entirely free from sophistication of any kind.
4. That it contain not more than 2 per cent. of sand.
5. That it be sold in good, merchantable condition.

The Merchandise Marks Act, which was brought forward shortly after my visit, had immediately the effect of causing the word "pure" to disappear almost entirely from the brands and invoices of seed-crushing firms, though some few firms of high standing, confident in the quality of their cakes, have had the courage to keep to it. There never was a time when farmers should more strongly insist upon having only pure cakes supplied to them, and make a point of getting a guarantee for the cakes being so. It is a frequent practice for a manufacturer or dealer to put forward an analysis giving merely the percentage figures of the different constituents. But it must be remembered that it cannot be a matter of indifference whether what is stated in an analysis as "oil" is *linseed* oil or some other of inferior value; and similarly whether the nitrogen and other elements arise from *linseed* or from some less valuable material. I would urge this necessity of insisting upon *pure* cake being used, inasmuch as, so soon as admixture of any kind is admitted, there is no limit to its quantity or its nature; for this reason I have been unable thoroughly to accept what is known as the "95 per cent. pure" standard, for it leaves out of account the important point as to the nature of the remaining 5 per cent. Nor has chemical analysis yet arrived at that point at which it is possible to say, after the seed has been crushed, whether 5 per cent. or not of foreign seeds previously existed in it; only an approximate result at best can be obtained.

The information given in the Quarterly Reports of the Chemical Committee makes it unnecessary for me to refer in detail to other adulterants in frequent use; I may briefly say that in addition to rape, cockle-seed, mill-sweepings, niger-seed, locust-bean, and hemp have been the principal ones.

American linseed-cakes have generally been pure, though, as usual, hard-pressed. In English-made cakes the percentage

of oil has not on the whole decreased, and several firms, I have reason to believe, have done well in offering cakes guaranteed to possess a high percentage of oil. Last year I commented on many instances that had come under my notice, of *sand* existing to a large degree in linseed-cakes. This year, I am happy to say, there has been a decided decrease in the quantity, though the 2 per cent. margin, which I have ventured to suggest in my recommendations for "pure" cake, is still too frequently exceeded.

In a great number of cases which have been brought under the notice of the Chemical Committee, cakes have been offered to purchasers at prices at which it is impossible to produce a pure cake; and while the doctrine of *caveat emptor* may to a certain extent apply, and purchasers should not allow themselves to be tempted too much by low prices, it is I think far worse that unscrupulous traders, by offering such inducements, and professing cakes to be pure which are not really so, should undersell honest makers of pure cakes.

Decorticated Cotton-Cake.—As predicted in my last year's report, the percentage of oil in this kind of cake has gone lower and lower, until it is quite a rarity to come across a cake having even 12 per cent. of oil. This lowering of the oil has been accompanied by inferior mechanical condition, and I have had many instances brought before me where feeders have given up the use of this cake on the latter ground. Still, here and there a good cake is occasionally to be found, one or two firms showing an aptitude for picking up a good cargo as soon as it arrives. The following is a case in point:—

Moisture	10·15
Oil	15·07
[1] Albuminous compounds (flesh-forming matters)	46·12
Digestible fibre, &c.	19·51
Woody fibre (cellulose)	3·70
Mineral matter (ash)	5·45
	100·00
[1] Containing nitrogen	7·38

This was a rich and soft cake, and in June 1887 it cost only 6*l.* 5*s.* a ton, delivered in Oxford, which is a price by no means more than much inferior qualities of decorticated cotton-cake were selling for at the time. Indeed, I find generally that the good cakes cost no more than the bad ones.

Undecorticated Cotton-Cakes have been generally free from impurity, though the complaints as to the husk being very coarse and having much cotton-wool still adhering to the seed are far from uncommon. The following two analyses are those of a kind of cotton-cake known as "Brazilian Cotton-Cake," which, whilst approaching the decorticated cotton-cake in composition,

has not the husk so much removed, and frequently has a considerable amount of hair still attached to it from the bags in which it has been pressed. As the vendor in one case rightly remarks, "it is very roughly crushed and requires care in using; only about half the usual quantity should be given." I would go a step further and say that this kind of cake is not one which I could recommend for use at all.

Moisture	9·10	10·45
Oil	11·17	10·90
[1] Albuminous compounds (flesh-forming matters)	42·80	35·90
Digestible fibre, &c.	25·06	26·50
Woody fibre (cellulose)	6·77	10·60
Mineral matter (ash)	5·10	5·65
	100·00	100·00
[1] Containing nitrogen	6·84	5·74

Rape-Cake, used as manure, has been hard to obtain pure or of good quality. Admixture of earth and dirt is very frequent, and cannot arise purely from accident, at least in the following sample which I examined:—

Moisture	7·13
[1] Organic matter	56·97
Phosphates	3·95
Alkalies, &c.	3·35
Sand	28·60
	100·00
[1] Containing nitrogen	3·56
Equal to ammonia	4·32

Rice Husk.—A sample of rice husk was sent to me, of which the following is the analysis:—

Moisture	8·98
Oil	1·50
[1] Albuminous compounds (flesh-forming matters)	2·63
Starch, digestible fibre, &c.	33·59
Woody fibre (cellulose)	38·53
[2] Mineral matter (ash)	14·77
	100·00
[1] Containing nitrogen	·42
[2] „ silica	13·08

This is a material which has but very little feeding value.

Niger- and Sunflower-Cake.—The following analysis may be found interesting:—

Moisture	9·02
Oil	7·50
[1] Albuminous compounds (flesh-forming matters)	31·00
Mucilage, digestible fibre, &c.	27·64
Woody fibre (cellulose)	15·57
[2] Mineral matter (ash)	9·27
	100·00
[1] Containing nitrogen	4·96
[2] Including sand	3·04

The price of this was 4*l.* a ton. The fibre, it will be noticed, was considerably higher than in linseed-cake, and bearing in mind the nature of the materials, I hardly think it compares well with linseed-cake.

Peruvian Guano.—The improvement in respect of guano noticed in my last report has been continued; and, generally speaking, the samples submitted have agreed well with the official analyses given, and the guanos have not been at all dear as compared with other manures.

Fish Guanos.—Last year I gave the results of determination of oil in several different samples, and spoke of the variation found in them. In two samples sent to me by a member of the society, which were both charged at the same price, I found the oil to vary considerably, one sample containing 11·4 per cent., and the other 21·9 per cent.

Sud-Cake.—A sample of this manure was sent to me with the request that I would determine the amount of potash present, of which it was said to contain a large quantity. It was stated to be made from the washings of wool after the oil had been squeezed out. The following is my analysis:—

Moisture	15·66
[1] Organic matter	34·29
Phosphate of lime	traces
Carbonate of lime	1·09
[2] Alkalies &c.	9·04
Sand	39·92
	100·00
[1] Containing nitrogen	1·81
Equal to ammonia	2·19
[2] Including potash (K_2O)	·27
Equal to sulphate of potash	·51

It will be seen that the amount of potash was very small, whilst there was nearly 40 per cent. of sand. The price, 20*s.* per ton at the works, would hardly bear the additional 10*s.* chargeable for carriage in the case under notice.

Sewage Sludge.—A rather large number of samples of this material have been sent me during the year. As showing the great variety among them I append the following analyses:—

	No. 1.	No. 2.	No. 3.
Moisture	58·40	43·01	45·45
Organic matter	14·80	12·85	12·43
Phosphate of lime	1·08	·26	3·53
Carbonate of lime	14·64	5·23	24·43
Oxide of iron, alumina, alkalies, &c.	2·24	4·64	3·34
Sand	8·84	34·01	10·82
	100·00	100·00	100·00
Containing nitrogen	·60	·49	·72
Equal to ammonia	·72	·59	·87

It is, of course, evident that very much depends on the proximity of the place of manufacture to the field on which the sludge is to be applied; indeed, this is generally the deciding factor. However, the above analyses show that in different sludges the composition varies greatly also. No. 1 cost about 4*s.* 6*d.* per ton upon the land, and this could not be considered too much; for spreading on grass land it would be serviceable. No. 2, costing about the same, would, I was informed, require screening as well; it is decidedly inferior in quality to No. 1, and far too dear. No. 3 is the richest of all, having considerably more phosphates, and also being higher in ammonia. This sludge, I was told, was put on rail free of charge, the cost of carriage to the sender of the sample being 11*s.* 3*d.* a ton. Though well worth having if near at hand, it would only just about cover the cost of carriage. These sewage manures, when sufficiently dry, as some of them are, might I think be usefully employed for mixing with concentrated artificial manures for the purpose of diluting them and procuring better distribution.

Basic Cinder.—I was in hopes of being able to report the results of some experiments on swedes which I have conducted with this material, upon two different fields at Woburn, especially as considerable public attention has been directed to basic cinder, which, if found to be of practical value, must prove a valuable addition to our supply of phosphatic manures. Unfortunately, however, owing to the extreme drought, the results, so far as the basic cinder is concerned, are not satisfactory; but so much is due to the untoward weather that it would be unfair to draw any conclusion as to the efficacy of the manure.

I have contributed the following Papers to the 'Journal' of the Society during the year:—

1. Report on the Field and Feeding Experiments at Woburn during the year 1886.
2. Report of Experiments on Ensilage at Woburn, 1886–87.
3. Sheep-Feeding Experiments at Woburn during 1886–87.
4. Report on the Experiments conducted in 1886 by Local Agricultural Societies in conjunction with the Royal Agricultural Society of England.

List of Analyses made for Members of the Royal Agricultural Society of England from December 1, 1886, *to November* 30, 1887.

Feeding-cakes	633
Compound-cakes	23
Feeding-meals	37
Superphosphates, dissolved bones, and compound manures	295
Guanos	50

List of Analyses—continued.

Coprolites	3
Bones, bone-meal, &c.	103
Refuse-manures	66
Manure-cakes	36
Fish-manures	27
Dried blood	4
Wool-dust and shoddy	27
Nitrate of soda	42
Kainit and potash salts	30
Sulphate of ammonia	33
Soot	6
Lime, limestone, gypsum, marls, minerals, &c.	7
Soils	26
Waters	89
Examinations for poison	8
Ensilage	10
Miscellaneous	4
	1559
Woburn experiments, analyses for	56
Total	1615

XVIII.—*Quarterly Reports of the Chemical Committee.*

April, 1887.

1. The Committee insert the following case and the correspondence to show how very flexible is the makers' definition of "pure" cake.

The Committee cannot accept this definition of "pure."

On October 2, Mr. W. Wright, of Wollaton, Nottingham, sent for analysis a sample of linseed-cake. Dr. Voelcker's analysis and report were:—

"October 9, 1886.

Moisture	12·06
Oil	10·40
[1] Albuminous compounds (flesh-forming matters)	24·19
Mucilage, sugar, and digestible fibre	36·00
Woody fibre (cellulose)	8·73
[2] Mineral matter (ash)	8·62
	100·00
[1] Containing nitrogen	3·87
[2] Including sand	3·78

"This is by no means a pure cake—was it sold to you as such?

"J. Augustus Voelcker."

Two tons of this cake had been purchased, at 7*l.* 17*s.* 6*d.* per ton, from Messrs. H. & F. Warhurst, Queen's Walk Wharf,

Nottingham, agents for Messrs. Alfred Denniss & Co., 191 High Street, Hull. The invoice was as follows:—

"September 4, 1886.
To 2 tons P. Lin. Cake | 7/17/6 | 15*l.* 15*s.* 0*d.* | "

In reply to Dr. Voelcker's inquiry, Mr. Wright said that the cake was sold to him as pure. A few days later he forwarded the following correspondence:—

"Alfred Denniss & Co., 191 High Street, Hull:
October 21, 1886.

"Messrs. H. & F. Warhurst.

"DEAR SIRS,— . . . 95 per cent. cakes have from 1 to 3 per cent. of sand in, according to the class of seed used. The finest Baltic Seed has, say, 5 per cent. ash, of which about 1 per cent. is sand. E. J. seed-cakes of the finest quality about 7 per cent. ash, which contains about 2 to 3 per cent. sand. Of course, no sand would be added in manufacture of the cakes. Thus you see that sand is more or less in all cakes, and the percentage rises or falls according to the price paid for the cake.

"As to the term *pure cake*, that term has no definite meaning. It is a term of degree. The highest class cakes containing 95 per cent. purity are at the highest price, and, as the price declines, the percentage of purity does—there being 30*s.* difference between K.G.'s and 95 per cent., but the delivery, we believe, sent to your friend *may* accidentally have been not quite up to the usual standard. The E. J. seed has pieces of earth here and there which are riddled out, but dust is left and this makes ash.

"In all cakes not 95 per cent. the percentage of ash will be rather high—say in B.W., W.H., and B.

"We shall be glad to have the further report your friend speaks of. Did he expect 95 per cent., think you?—Yours faithfully,

"A. DENNISS & CO."

"The K.G.'s are nice, very, to-day—new seed."

"Alfred Denniss & Co., 191 High Street, Hull:
October 22, 1886.

"Messrs. H. & F. Warhurst.

"DEAR SIRS,—We think you will find the percentage of purity in the K.G.'s as high as in any other cake at the same price. We enclose analysis of a 95-per-cent. cake containing nearly 8 per cent. of ash, which would have at least 3 per cent. of sand. This by Dr. Voelcker, and the price is 8*l.* 5*s.* in Hull. If Dr. V. be told the price of the K.G.'s, we think he will say it is worth the money paid.

"Will you please send us part of the cake analysed that we may have it tested, also copy of Voelcker's analysis and report? He may have made an error, and any one who circulates erroneous reports we shall hold liable. If any error has been made in the delivery we shall be glad to take the cake back or make compensation, but the inferiority must first be tested by ourselves.—We are, yours truly, "A. DENNISS & CO."

"Nottingham."

The following letters passed:—

"W. Wright, Esq. "December 1, 1886.

"DEAR SIR,—I am obliged for the correspondence sent me. I ought to tell you in reference to Messrs. Alfred Denniss & Co.'s letters, that my remarks as to the cake being by no means pure, were not confined at all to the

sand in the cake, though the amount of that is sufficiently large. The cake, besides this, contains a large quantity of foreign seeds and starchy bodies. Among these foreign seeds I find *Cotton-seed*, *Niger*, and *Polygonum*, in some amount. The impurities account for the cake being lower in nitrogen than it ought to be.—Yours faithfully, "J. AUGUSTUS VOELCKER."

"Wollaton, Nottingham: December 20, 1886.

"DEAR SIR,—I am much obliged by your letter of the 18th inst.

"I have done nothing farther with Messrs. Warhurst. They called at my office a day or two ago, and made a long statement very much like the explanation given in the merchant's letter which I sent to you.

"I could simply say that I had nothing to do with that; I must be guided entirely by your report and analysis. I do not see what I can do further in the matter. . . .

"I shall be happy, however, to act upon any suggestion you may make.—Believe me, yours very truly, "WM. WRIGHT."

"Dr. J. A. Voelcker."

"W. Wright, Esq., Wollaton, Nottingham. "December 24, 1886.

"DEAR SIR,—I am much obliged for your letter of the 20th. There remains nothing more but to thank you for the particulars sent. I will lay these before the Chemical Committee, who will take such action as they think fit.

"I presume you will communicate to the vendors the contents of my letter of December 1, so that if they, or the manufacturers, desire to make any explanation before the case is mentioned again (end of January), they can do so. I take it that they have not made you any allowance for the cake.

"Messrs. Denniss in their letter to Messrs. Warhurst, October 2, say—'If any error has been made in the delivery, we shall be glad to take the cake back or make compensation.' I should be glad to hear, if it is not troubling you too much, whether either of these proposals has been acted on.—Yours faithfully, "J. AUGUSTUS VOELCKER."

"Wollaton, Nottingham: December 28, 1886.

"DEAR SIR,—In reply to your letter of 24th inst., I have this day sent to Mr. Warhurst all the correspondence between us, so that the manufacturers of the cake and himself may be fully informed of what is going on, and have the opportunity which you suggest of giving any explanation.

"They did not take the cake back, for the simple reason that it was all consumed before I received your analysis. They have not made any compensation, probably because there is still an outstanding account due from me to them, and they may be intending to make some deduction when this is settled, but I delayed paying any more money until matters were cleared up.—I am, dear Sir, yours faithfully, "WM. WRIGHT."

"J. A. Voelcker, Esq., 12 Hanover Square, London, W."

"Alfred Denniss & Co., 191 High Street, Hull:

"Dr. J. A. Voelcker. January 8, 1887.

"DEAR SIR,—You have analysed a sample of linseed-cakes supplied through Messrs. H. & F. Warhurst, of Nottingham, by us, to Mr. W. Wright, of Wollaton, Nottingham, who states the analysis to be inferior, but will not furnish a copy, and refers us to yourself; we should be obliged by your sending us one.—We are, yours truly, A. DENNISS & Co."

"P.S.—The sample is No. 1,403. We should be glad to receive also part of the sample, which may not fairly represent the bulk.

"Please also state the brand on the cake. There may be some error here."

"January 15, 1887.

"Messrs. Alfred Denniss & Co., 191 High Street, Hull.

"Dear Sirs,—Mr. Wright, of Wollaton, informed me on December 28, 1886, that he had sent to Messrs. Warhurst the whole of the correspondence that had passed between us, so that the latter gentlemen will be able to give you the full particulars.

"At the same time, I will write to Mr. Wright and tell him he will be quite in order in giving you a copy of my analysis and remarks.—Yours faithfully, "J. Augustus Voelcker."

"Wm. Wright, Esq., Wollaton, Nottingham. "January 15, 1887.

"Dear Sir,—I hear from Messrs. Denniss & Co. that they cannot obtain from you a copy of my analysis and remarks on the cake. I beg to inform you that *in cases of dispute*, such as this, it would be quite in order for you to give Messrs. Denniss a copy of my analysis and remarks, and of my letter of December 1, explaining what the impurities were, and that I thought it only fair that you should do this if they applied for it.—Yours faithfully, "J. Augustus Voelcker."

"Alfred Denniss & Co., 191 High Street, Hull:

"Dr. J. A. Voelcker. January 17, 1887.

"Dear Sir,—We are obliged by your letter, and have written Messrs. Warhurst to get us copy of your report and analysis.

"In yours of December 1, to Mr. Wright, you state you found cotton and niger-seed in the cake. Now, if the cake you have analysed is ours, you are in error in these respects, and we request you will have the goodness to inform Mr. W. of your mistake.

"It is a by no means infrequent thing for analysts to wrongly describe the constituent seeds of an oil-cake.

"You say 'the cake is by no means *pure*.' Now we are not aware that the Royal Agricultural Society of England has a standard of purity for cakes, nor have you or your predecessor fixed a standard, therefore it is absurd to talk of a cake being *pure* or not *pure*. We believe the law will allow cakes made of linseed as imported to be called 'pure.' Are you aware that seed as imported contains from 5 to 50 per cent. of foreign matter other than line seeds? What, therefore, becomes of your definition? We object personally to *pure* on any cakes, as there is not an absolutely pure cake. The presence of 1 per cent. of impurity in the seed destroys the principle of purity. In the finest cakes guaranteed 95 per cent. purity you admit by that guarantee the presence of five per cent. of impurity. The term 'pure' therefore becomes a trade term of degree. The highest price 'pure' cakes, containing the highest percentage of purity, are the highest price, and as the price declines the percentage of purity declines. The cake, however, 30*s*. per ton less in price than 95 per cent. purity may be as well worth the money as the 95 per cent.

"We blame the R.A.S. of E. for fixing no standard—after first consulting with the cake vendors and seed importers of the country, and also for not taking steps to have the food for cattle protected by a similar Act as that dealing with the adulteration of food for human beings.

"The cake Mr. Wright received was a good useful cake, and no doubt his stock did well on it, but it was not 95 per cent., being sold at 25*s*. and 30*s*. below the price of 95 per cent. We enclose one of our *trade* circulars —showing that 'pure' covers a range of value from 6*l*. 12*s*. 6*d*. to 8*l*. 5*s*.

"We do what we can to induce buyers to buy the best cakes, but they will have what is the cheapest. Our prices are for dealers who retail out to consumers.

"We contend that Mr. W. got the full value that he paid for.—We are, yours truly, "A. DENNISS & Co.

"P.S.—We sell about 15,000 tons oil-cakes per annum, but the quantity of 95 per cent. linseed-cakes included is not large. It is however growing.

"ALFRED DENNISS & Co."

"191 High Street, Hull: January 26, 1887.

"Dr. J. A. Voelcker.

"DEAR SIR,—I have not been favoured with a reply to my letter of 19th inst. I consider your analysis and report have done injury, which I feel sure you will be willing to repair without any undue pressure from me. I again, with firmness but respect, request you will at once explain your mistake as to the cotton-seed and niger-seed, which you erroneously stated were in the cake to Mr. Wright; and also state what you intended by the term 'pure.'

. . . .

"Esteeming your reply, I am, yours truly, ALFRED DENNISS."

"Alfred Denniss & Co., 191 High Street, Hull: January 19, 1887.

"Dr. Voelcker.

"DEAR SIR,—We have received the analysis from Mr. Wright, No. 1,403, but there is nothing on it showing it to be of our cake. It is simply called 'Linseed-cake;' but presuming there is no error and that it is the 'K.G. Pure' brand we will comment thereon. We have requested Mr. W. to send us sample from the bulk that we may test your analysis.

"The analysis is that of a *good* linseed-cake. There is nothing injurious in it. It is as pure in principle as the very finest, but not in degree. You say:—'This is by no means a pure cake, was it sold as such?' In reference to this extremely ambiguous statement and query, we refer to our letter of 17th inst.

"We presume you meant to say that the cake was not from the finest Linseed; was it sold as such? It is not of the finest quality, and was not sold as such. It is average Hull quality, and was sold at a price in accordance; at a price which represents its value as a feeding cake. We sold it to Messrs. Warhurst at 6*l.* 15*s.* per ton, and they put their profit of, we believe, some 10*s.* per ton on to that price—a reasonable profit for a dealer to charge the farmer, who takes, often, long credit; 6*l.* 15*s.* being the wholesale prompt cash price. A 95 per cent. pure would have been 25*s.* to 30*s.* more than this.

"Will you please tell Mr. W., that as you understand the price charged was so much less than the price of a perfect cake, that you consider he has got good value for the price charged?

"If the matter is brought up before your committee we hope you will read our letter of the 17th instant, and show our circular manifesting the different qualities of pure. We should like to sell nothing but 95 per cent., but the buyers will have the lowest-priced cakes, all of which that we sell are very good value at the money,—We are, yours truly,

"A. DENNISS & Co."

The following extract is from the circular referred to in Messrs. Denniss's letter:—

"191 High Street, Hull: December 31, 1886.

"DEAR SIR,—We beg to submit our to-day's prices, free to cart or craft at mill or warehouse as under:—

"Linseed-Cakes.

	Per ton. £	s.	d.
** Pure, 95 per cent. purity (Hull shape) . .	8	0	0
D. B. Pure do. do. . .	8	5	0
Anglo Pure do. (Thin narrow shape) . .	8	2	6
S. X. Pure do. . .	6	17	6
K. G. Pure (Hull shape)	6	15	0
A. D. Pure do.	6	15	0
P. B. Pure do.	7	0	0
S. G. Pure do.	6	12	6
B. Pure do.	7	5	0
T. T. Pure do.	6	12	6
B. F. Pure do.	None		
S. H. S. Pure (Anglo)	None		

"Linseed-Cakes.—A quiet trade at firm prices. It cannot be too widely explained to any ignorant of the fact, that the word 'pure' covers a range of values differing 30*s.* per ton, and that buyers can have the highest percentage (95 per cent.) of purity if they will pay the price, but that naturally the percentage of purity declines as the price declines, though the cheaper cakes at their prices may be as well worth them as the 95 per cent. theirs.

"In Hull makes we recommend S. X. 95 per cent. Pure at 8*l.* 2*s.* 6*d.*; ** 95 per cent., 8*l.*; S. Pure, 6*l.* 17*s.* 6*d*; A. D. Pure, 6*l.* 15*s.*; K. G. Pure, 6*l.* 15*s.*; S. G. Pure, 6*l.* 12*s.* 6*d.*; T. T. Pure, 6*l.* 12*s.* 6*d.*"

The correspondence was continued as follows:—

"Messrs. Alfred Denniss & Co. "February 10, 1887.

"Dear Sirs,—I have your several letters in reference to the cake analysed for Mr. Wright, of Nottingham.

"You ask me to write to Messrs. Warhurst informing them of a supposed error that I have made; but as no error whatever has been committed, you must excuse me from doing this. You admit the term 'pure' both in your letters and circulars, and the cake was supplied to Mr. Wright under that description. Considering, as I do, that the word 'pure,' even in a qualified sense, ought by no means to be applied to such a cake as the one I examined, I reported on it as I did.—Yours faithfully,

"J. Augustus Voelcker."

"Alfred Denniss & Co., 191 High Street, Hull: February 11, 1887.

"Dear Sir,—Your letter received. We asked you to withdraw the allegation of the presence of niger and cotton-seed in your analysis, as they did not exist. This is a reasonable request, and we beg respectfully to repeat it.

"As to the term *pure* we disapprove of its presence on any cake, but cannot control the trade; we are vendors, not manufacturers, and we do all we can, as you will have seen from our circular, to put the trade on a logical and fair basis; but we do think, with all due respect, that you do not do your part in bringing this about. We, however, need not reiterate what we have already stated. The thing ought to be ventilated in the public journals.—Yours truly, "A. Denniss & Co."

"12 Hanover Square, London, W.: February 12, 1887.

"Dear Sirs,—I told you in my letter that I had made no mistake whatever, and therefore I have nothing to withdraw.

"I have the cake in question by me, and am at any time prepared to show the presence of the foreign seeds I named as occurring in it.—Yours faithfully,

"J. A. VOELCKER."

"Alfred Denniss & Co., 191 High Street, Hull:
February 14, 1887.

"Dr. Voelcker.

"DEAR SIR,—We are obliged by your letter, but distinctly affirm that there was neither niger nor cotton-seed in the cake. We should be glad if you would send us a small piece of the cake you analysed that we may inspect it to see whether it is our cake, and to have it tested. You desire, like ourselves, nothing but the truth, we are sure.—Yours faithfully,

"A. DENNISS & Co."

"12 Hanover Square, London, W.: March 7, 1887.

"Messrs. Alfred Denniss & Co., 191 High Street, Hull.

"DEAR SIRS,—The matter of Mr. Wright's cake was laid before the Chemical Committee at their meeting on March 1, and after a consideration of the circumstances I was requested to inform you that it is against the Society's rule to send to others the samples which have been forwarded for analysis by private individuals. At the same time I have to inform you that the cake is retained here, and if you wish to see it, or send any one as representing you for the purpose, you are at liberty to do so.—Yours faithfully,

"J. AUGUSTUS VOELCKER."

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2. Mr. W. T. Culverwell, of Durleigh Farm, near Bridgwater, sent on December 9, 1886, a sample of linseed-cake marked "C. D.," which was reported on thus:—

"December 18, 1886.

Moisture	12·55
Oil	10·33
[1] Albuminous compounds (flesh-forming matters)	20·15
Mucilage, sugar, and digestible fibre	36·95
Woody fibre (cellulose)	12·07
[2] Mineral matter (ash)	7·95
	100·00
[1] Containing nitrogen	3·22
[2] Containing sand	3·03

"A cake grossly adulterated with starchy compounds. As a consequence it is excessively low in nitrogenous bodies. It ought to have from 4 to 4½ per cent. of nitrogen.

"J. AUGUSTUS VOELCKER."

Mr. Culverwell purchased a ton of this cake at 8*l*. per ton, but refused to give the vendors' name, writing as follows:—

"Durleigh Farm, nr. Bridgwater: January 31, 1887.

"DEAR SIR,—In reply to yours of Jan. 27th, I beg to say that the cake, No. 47, was bought subject to analysis, but no analysis mentioned; the vendor has very fairly met me on the price, therefore I do not wish to expose the name.—Yours respectfully,

"W. T. CULVERWELL."

"J. A. Voelcker, Esq.'

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3. Mr. Gerard C. Meynell, of 20 Whitehall Place, S.W., sent on January 26, 1887, on behalf of the Right Hon. Sir W. Hart-Dyke, Bart., M.P., a sample of linseed-cake, 4 tons of which had been purchased at 8*l.* 2*s.* 6*d.* a ton from Mr. T. Millhouse, Horton Kirby Flour Mills, Dartford, agent for the Oil Seed Crushing Company, Dover. The analysis and report were:—

"February 2, 1887.

Moisture	12·01
Oil	10·49
[1] Albuminous compounds (flesh-forming matters)	18·37
Mucilage, sugar, and digestible fibre	37·91
Woody fibre (cellulose)	11·77
[2] Mineral matter (ash)	9·45
	100·00
[1] Containing nitrogen	2·94
[2] Including sand	5·14

"This is an adulterated cake, containing quantities of locust bean, also cotton husk and other foreign seeds, besides over 5 per cent. of sand. The cake in consequence shows an extremely low percentage of nitrogen, and proportionately high fibre. "J. Augustus Voelcker."

The following correspondence is a full record of the transaction up to its conclusion:—

T. Millhouse to Meynell & Pemberton.

"January 4, 1887.

"Being agent for the Oil Seed Crushing Company, Dover, I can offer you linseed-cake at 8*l.* 2*s.* 6*d.* per ton, delivered in four-ton lots, at Eynsford Station, carriage paid; if less than four tons, 1*s.* 6*d.* per ton extra. If you should be buyers I will have the order lodged so that you may have it delivered any time this month."

Mr. Meynell to T. Millhouse.

"January 5, 1887.

"I am obliged by your letter of the 4th instant. What percentage ot oil and of purity can you guarantee in the cake you offer at 8*l.* 2*s.* 6*d.* per ton?"

T. Millhouse to Mr. Meynell.

"January 6, 1887.

"The linseed-cake I quoted to you is the same as used by Robert Russell, Esq., and all the principal farmers. They tell me their stock do well on it. The Dover Oil Crushing Company do a large business, and I have always found the cake of good quality and sell a great quantity."

T. Millhouse to Mr. Meynell.

"January 13, 1887.

"I beg to acknowledge receipt with thanks, and any order you favour me with shall be booked at the lowest price. The Dover Mills will deliver a lower quality linseed-cake at 10*s.* per ton less than the 8*l.* 2*s.* 6*d.* quality quoted to you last week. Bran is 85*s.* per ton at the mill."

MR. MEYNELL TO T. MILLHOUSE.

"January 15, 1887.

"On the terms mentioned in your letter of the 4th instant, please send four tons of linseed-cake addressed to Mr. E. Lawrence, Eynsford Station, and inform me and Mr. Lawrence when it is sent."

T. MILLHOUSE TO MR. MEYNELL.

"January 19, 1887.

"The four tons of linseed-cake has been sent to Eynsford Station to the order of Mr. E. Lawrence. I have also by this post sent a number of cakes, 946, that he may see the delivery is correct."

"[COPY INVOICE.]

"HORTON KIRBY FLOUR MILLS.

"LULLINGSTONE ESTATE.

"To T. MILLHOUSE, Corn, Linseed-cake, and Seed Merchant.

1887.

January 20,—4 tons linseed-cake . . . . . . 32*l*. 10*s*. 0*d*."

MR. MEYNELL TO T. MILLHOUSE.

"February 11, 1887.

"I have to-day received your bill for four tons of linseed-cake, and simultaneously the report of the Consulting Chemist of the Royal Agricultural Society of England, to whom I sent a specimen of the cake for analysis. He reports that this is an adulterated cake, containing quantities of locust-bean, also cotton-husk, and other foreign seeds, besides over five per cent. of sand. The cake in consequence shows an extremely low percentage of nitrogen and proportionate high fibre. I shall be glad to know what remarks you have to make on this report, and whether you are prepared to take back the unused portion of the cake, or what other course you are prepared to adopt."

T. MILLHOUSE TO MR. MEYNELL.

"February 15, 1887.

"I sent on your letter to Dover, and, by their reply, the (D) linseed-cake was sent in mistake, the price of which is 7*l*. 15*s*. per ton; the pure, 8*l*. 2*s*. 6*d*. I will take the unused back, and send the pure if you wish it."

OIL SEED CRUSHING COMPANY, LIMITED, TO T. MILLHOUSE.

"February 14, 1887.

"We have received your letter of the 12th inst., with enclosure, which we return herewith; and, in reply, our (D) linseed-cake is not as represented in the letter you send. You are aware that the cake is not pure, and if you have guaranteed it so, we should think it would be better for you to take back the unused portion, which we can exchange for pure at 7*s*. 6*d*. per ton more."

MR. MEYNELL TO T. MILLHOUSE.

"February 16, 1887.

"Your letter is scarcely satisfactory. When you offered the cake I inquired what percentage of oil and of purity you could guarantee, from which you should have understood that I desired a supply of practically pure cake. You offered a lower quality at 10*s*. (not 7*s*. 6*d*.) a ton less.

"The question, however, is not merely one of price. It appears that Sir William's cattle have been supplied with, and have eaten, a mixture containing worthless and injurious substances, a fact which I could not have discovered had I not sent a sample to the Consulting Chemist of the Royal Agricultural Society of England for analysis.

"I will now consult Sir William on the course to be adopted under the circumstances."

T. Millhouse to Mr. Meynell.

"February 17, 1887.

"Your letter to hand this morning respecting the cake. Had you asked me for a guarantee for its purity, I should have referred you to the makers.

"When I wrote to you I said it was the same cake many of the farmers —Mr. Robt. Russell and others—were using, and it had always given satisfaction. You mention the price I quoted you at the time being 10*s.* less (not 7*s.* 6*d.*). The price is not always the same, having this morning had a circular with an alteration, viz., 2*s.* 6*d.* per ton cheaper. I am sorry this misunderstanding should have been. I can assure you it is against my wish to wrong any one, which your letter almost said I had been guilty of."

Mr. Meynell to T. Millhouse.

"February 21, 1887.

"Since the date of my letter of the 16th instant, I have consulted Sir William on the subject of our correspondence. I am authorised to make the following offer to you, viz., that you at once send for and remove the remaining cakes, and that you be allowed at the rate of 6*l.* a ton for the quantity already consumed.

"This offer, if not accepted by Wednesday next, must be considered as withdrawn. In any case Sir William reserves liberty to make any use he may think proper of this correspondence.

"In regard to the last paragraph of your letter of the 17th inst., I may remark that your principals, in their letter to you of the 14th inst., appear to attempt to shift the blame from the manufacturer, and to attach it to their agent, by saying that you were aware that the cake was not pure, and that in effect the price was incorrect."

T. Millhouse to Mr. Meynell.

"February 22, 1887.

"I have written to the Oil Seed Company, and as soon as I have an answer will write and let you know if I am to accept your terms."

T. Millhouse to Mr. Meynell.

"March 1, 1887.

"I have this day sent for the unused cake and find it to weigh 1 ton 18 cwt. 3 qrs. Also enclosed samples of seed oats, with the price, should you be buyers."

Mr. Meynell to T. Millhouse.

"March 2, 1887.

"You mention that you have removed the unused linseed-cake, but you do not state whether or not you accept the offer of 6*l.* per ton for the quantity used. Assuming the quantity you name as being returned, viz., 1 ton $18\frac{3}{4}$ cwts., to be correct, the quantity to be paid for is 2 tons $1\frac{1}{4}$ cwts., which at 6*l.* per ton would be 12*l.* 7*s.* 6*d.*, for which I am prepared to advise Sir William to sign a cheque."

T. MILLHOUSE TO MR. MEYNELL.

"March 3, 1887.

"I have had a letter from the Company in which they say the cost of the cake to them is 7*l.* 7*s.* 6*d.* per ton. I will leave it in your hands to pay what you think right."

MR. T. MEYNELL TO T. MILLHOUSE.

"March 10, 1887.

"In reference to your letter of the 3rd instant, leaving in my hands the question of payment for the adulterated meal, I have advised Sir William Dyke to pay you for the 2 tons $1\frac{1}{4}$ cwt. used at the rate of 6*l.* 5*s.* per ton, and enclose accordingly his cheque for 12*l.* 17*s.* 6*d.* and shall be obliged by your receipt in full. Had the cake been simply adulterated with locust bean, my task in deciding the amount Sir William might be advised to pay would have been more simple, but the large admixture of injurious substances is not so easily dealt with."

No letter was sent with the receipt, of which the following is a copy:—

"HORTON KIRBY FLOUR MILLS.

"THE LULLINGSTONE ESTATE.

"To T. MILLHOUSE, Corn, Linseed-cake, and Seed Merchant.

1887.		
January 20,—4 tons linseed-cake		£32 10 0
CR. by $38\frac{3}{4}$-cwt. returned . . .	£15 14 9	
Cheque	12 17 10	
Tare	3 17 5	
	£32 10 0	

"Received payment as above, March 11, 1887. T. MILLHOUSE."

JULY, 1887.

The Committee had before them a case, typical of many which have happened of late, in which the purchaser, a member of the Society, had followed the recommendations issued by the Society—viz., in the case of linseed-cakes, to insist on having the word "pure" inserted on the invoice; but in which the intention had manifestly been to evade the guarantee by the insertion of a qualifying sign, word, letter, or letters preceding "pure."

It is maintained by some makers and dealers that the use of such qualifying prefix does not necessarily carry with it the guarantee of purity, but merely specifies a particular brand or quality of cake.

The Committee are conscious of the fact that were these qualifying prefixes generally accepted by the trade as bearing such interpretation, great injury would be caused both to the agricultural interest and to honourable manufacturers of and dealers in cakes.

The Committee, therefore, propose in future to take cogni-

zance of all cases of adulteration reported to them in which the word "pure," whether stated on the invoice or branded on the cake, has been used, with or without any prefix.

1. Mr. T. Goodall, of the Park Farm, Hurleston, Nantwich, sent on February 19, 1887, a sample of boiled bones. $4\frac{1}{4}$ tons had been ordered, at 4*l*. 2*s*. 6*d*. per ton for cash, the bones to be genuine. The vendor was Mr. Samuel Smith, of Hargreaves Street, Rogers Street, Redbank, Manchester, who was the manufacturer. The analysis was as follows :—

"March 2, 1887.

Moisture	13·68
[1] Organic matter	18·47
Phosphate of lime	42·57
Common salt (chloride of sodium)	2·65
Sulphate of lime	18·73
Carbonate of lime, &c.	3·00
Insoluble silicious matter	·90
	100·00
[1] Containing nitrogen	1·17
Equal to ammonia	1·42

"This sample is adulterated with sulphate of lime (gypsum), and has also over $2\frac{1}{2}$ per cent. of salt; by this admixture it is lowered in value to the extent of about 1*l*. a ton. "J. AUGUSTUS VOELCKER."

After inquiry made as to how the case had been settled, Mr. Goodall wrote on May 3: "Mr. Smith allowed me a deduction of 1*l*. per ton, as suggested in your letter."

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2. Mr. H. Potter, of Bentwood, Arnold, Notts, bought two tons of bone-dust at 6*l*. 15*s*. a ton, and sent a sample for analysis, the result of which is given below :—

"April 11, 1887.

Moisture	16·26
[1] Organic matter	27·30
Phosphate of lime	40·79
Carbonate of lime, &c.	5·67
Chloride of sodium (common salt)	5·79
Insoluble silicious matter	4·19
	100·00
[1] Containing nitrogen	2·86
Equal to ammonia	3·47

"This is a low quality sample, adulterated with nearly 6 per cent. of salt. "J. AUGUSTUS VOELCKER."

The name of the vendors was not forthcoming, Mr. Potter saying that he had promised not to give it; they were friends and close neighbours. The vendors, however, made an allowance of 25*s*. a ton.

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3. Mr. C. P. Harvey, of Sudborough, Thrapston, ordered on February 24, 1887, four tons of a manure described to him as "patent carbon fertiliser" for oats, the price being 4*l*. a ton. The vendors were Messrs. Hewes, Hewes & Geary, of Coalville, near Leicester, they being also the manufacturers. The firm was described as the manufacturers of the Hygeian Disinfecting Powder and Hewes' Anti-incrustation Powder, &c.

Dr. Voelcker's analysis gave the following results:—

"March 24, 1887.

Moisture	20·51
[1] Organic matter	11·82
Oxide of iron and alumina	6·59
Phosphate of lime	4·26
Carbonate of lime	21·81
Alkalies, &c.	2·68
Insoluble silicious matter	32·33
	100·00
[1] Containing nitrogen	·65
Equal to ammonia	·79

"A material not worth a sixth of what it costs.

"J. Augustus Voelcker."

In answer to Mr. Harvey's complaint the following letter was received:—

"MEMORANDUM.

"From
HEWES, HEWES & GEARY,
Manufacturers of the
'Hygeian' Disinfecting Powder and
Hewes' Anti-incrustation
Powder, &c., &c., Coalville, near
Leicester.

March 28, 1887

To
C. P. HARVEY, Esq.,
Sudborough,
Thrapston.

"Dear Sir,—In reply to your favour of the 25th, which has been handed to me, I herewith give you a full explanation of the analysis of the 'Patent Carbon Fertiliser' as supplied by our firm.

"I will take the analysis as it stands.

"1st.—The moisture = 20·51 per cent. No doubt it will somewhat surprise you when I state that the moisture is the special feature of our manures, and it is not a simple stinking bone oil put in to acquire a suitable density for the manure, but a liquid extract distilled from solid excreta by our own special patent process, at a very considerable cost, and cannot be supplied by any other firm in the world; the moisture in one ton of our manure is worth in itself to us 2*l*. 15*s*., as we can sell it readily for turnip-dressing at 2*l*. per cask of 40 gals. I send you by this post sample of the liquid extract, twenty per cent. of which is equal as a fertiliser to twenty-five per cent. of soluble phosphates, and eight per cent. of sulphate of ammonia—we practically tried and proved it.

"2nd.—The organic matter is quite right, the percentage of nitrogen varies a little. The greater part of the ammonia would come off in analysis

with the moisture on heating, as the alkalies present would liberate the ammonia.

"3rd.—The other part of the analysis is up to standard, the alkalies rather above.

"4th.—The insoluble silicious matter is principally fine granular garden sand, for the purpose of preventing the liquid extract forming a solid cake with the carbonate and phosphate of lime and organic carbon matter.

"I can guarantee that you will be perfectly satisfied with the result you will get after using it.

"The analysis is quite right, but the generality of manures have their principal ingredients in solids, but this being of a volatile nature, in analysis, would at once come off and be registered as moisture, and its composition would not be noticed.

"Trusting this explanation will be sufficiently explicit to afford to you satisfaction as to its quality. Any further information you may require I shall be most happy to forward you, or if preferable will come over and see you.

"I was not at all surprised at the tone of your letter, as it is the first time it has been sent to Dr. Voelcker, and he, not knowing the nature of the moisture, would fail to notice any peculiarity in it. I put the terms—three months—on the invoice so that you will have the opportunity of seeing something of the effect before paying for it.

"Sincerely hoping we may be favoured with your further orders for root manures, satisfaction of which we will guarantee.—Yours obediently,

"FRED. C. GEARY, Chemist to the firm."

Dr. Voelcker wrote on May 4:—

"C. P. Harvey, Esq., Sudborough, Thrapston. "May 4, 1887.

"OAT MANURE.—No. 461.

"DEAR SIR,—I am much obliged to you for sending particulars about the Carbon Fertiliser, and am very much amused with the letter which the vendors send. The process of analysis which I adopt would not allow any ammonia that the material might contain to escape estimation, and the water and the fine sand, however useful they may be to the manufacturer, are not of value to you.

"The manure is one quite unsuited for a crop of oats, and, as I said, is not worth one-sixth of what it costs.

"Will you kindly let me know how the matter has been settled?—Yours faithfully, "J. AUGUSTUS VOELCKER."

The makers wrote on June 13 as follows:—

"C. P. Harvey, Esq., Sudborough, Thrapston.

"DEAR SIR,—In answer to yours of the 11th inst., *re* manure for corn crops, we thank you for your offer of one-sixth, but would prefer waiting until the corn is cut, when you will be better able to judge the value of the manure, and unless the yield is satisfactory we would rather take no pay at all.

"We do not wish to say anything against Dr. Voelcker's process for manure analysis, but, nevertheless, we know 'practically' as well as 'chemically' what our manures are capable of doing, and unless we had perfect confidence in them we should not think of pushing them.

"Hoping to hear your decision after harvest, we are, yours faithfully,

"HEWES, HEWES & GEARY."

4. A member of the Society sent on March 10, 1887, a sample of linseed-cake which he had been giving to a valuable thoroughbred filly, nine months old, together with other food. The filly was seized with general paralysis, and her life was in considerable danger. Thinking the cake might be the cause, the member referred to forwarded a sample for analysis, of which the following is the report:—

"March 23, 1887.

Moisture	12·32
Oil	8·41
[1] Albuminous compounds (flesh-forming matters)	27·44
Mucilage, sugar, and digestible fibre	36·47
Woody fibre (cellulose)	8·97
Mineral matter (ash)	6·39
	100·00
[1] Containing nitrogen	4·39

"This is a cake low in oil and very impure. It contains an immense quantity of weed and other seeds, among which I recognise mustard. It is one of the worst cakes I have examined for a considerable time.

"J. AUGUSTUS VOELCKER."

The cake was shipped from South Riga, and was stated to be of Schmitz's manufacture. The name of the vendor could not be obtained.

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5. Mr. W. Hughes, of Norsted, Chelsfield, Kent, forwarded on March 18, 1887, a sample of "Sootigine," of which he had bought 10 tons at 35*s*. per ton, this material having been represented to him as equal to guano. The vendors were the New Carbolic Sanitary Company, Hackney, London. The analysis was:—

"March 28, 1887.

Moisture	21·91
[1] Organic matter	26·14
Phosphate of lime	traces
Oxide of iron and alumina	12·01
Carbonate and sulphide of lime, alkalies, &c.	21·57
Insoluble silicious matter	18·37
	100·00
[1] Containing nitrogen	·81
Equal to ammonia	·99

"About three times too dear; it is poor manure.

"J. AUGUSTUS VOELCKER."

Mr. Hughes wrote on May 2:—

"DEAR SIR,—I now send you the bill you ask for in your report on sample of sootigine, which in its application quite carries out your report,

and is, I fear, quite a useless manure. It was applied as a top-dressing to wheat early in February, and a piece was left not dressed, but I fail to see any difference where applied and where not.—Yours faithfully,

"Dr. J. Augustus Voelcker." "Wm. Hughes."

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6. Mr. W. T. Scarth, of Raby Castle, Darlington, sent on April 4 a sample of linseed-cake, on which the following report was given:—

"April 7, 1887.

Moisture	14·05
Oil	11·07
[1] Albuminous compounds (flesh-forming matters)	20·31
Mucilage, sugar, and digestible fibre	26 69
Woody fibre (cellulose)	18·93
[2] Mineral matter (ash)	8·95
	100·00
[1] Containing nitrogen	3·21
[2] Including sand	3·95

"This cake is an impure and nasty tasting one, containing, besides 4 per cent. of sand, cotton-husk, niger-seed, and other impurities. It is excessively high in indigestible fibre, and very low in nitrogenous matters.

"J. Augustus Voelcker."

A ton of this was purchased from an agent of the manufacturers, Messrs. Eyre & Co., of 6 High Street, Hull, and Sculcoates, Hull, and was invoiced as "+Pure," the price being 7*l.* 5*s.* per ton. A small quantity of the cake only had been used before its impurity was discovered, and the remainder of the delivery Mr. Scarth returned.

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7. Mr. J. E. Hill, of Gressenhall, Dereham, forwarded on May 10, 1887, a sample of manure bought as dissolved bones at 6*l.* a ton delivered. The analysis and report on this were—

"May 24, 1887.

Moisture	11·08
[1] Organic matter	25·26
Phosphate of lime	23·24
Sulphate of lime, &c.	33·18
Insoluble silicious matter	7·24
	100·00
[1] Containing nitrogen	1·74
Equal to ammonia	2·11

"This is not dissolved bones at all, and the price, 6*l.*, is very excessive; 4*l.* a ton would more than represent its value to you delivered.

"J. Augustus Voelcker."

Mr. Hill wrote on June 5:—

"DIS. BONES.—No. 882.

"DEAR SIR,—Having always had a good understanding with the man of whom I bought the dis. bones, and he having accepted my offer of 4*l.* for the ton, which I bought at 6*l.*, I cannot undertake to expose him.—I am, dear Sir, yours truly, "J. E. HILL."

"J. A. Voelcker, Esq."

DECEMBER, 1887.

In accordance with a resolution passed June 29, 1887, the Committee have now to report on a great number of cases where the word "Pure" with some qualifying prefix is stamped upon the cakes. They consider that the term "Pure" cannot be qualified by a prefix, and is not applicable to any cake which contains other materials than the article from which the cake professes to be made.

1. Major E. C. Robertson, of Widmerpool, Nottingham, forwarded for analysis on May 14, 1887, a sample of linseed-cake, the report upon which was:—

"June 8, 1887.

Moisture	9·10
Oil	7·84
[1] Albuminous compounds (flesh-forming matters)	27·43
Mucilage, sugar, and digestible fibre	33·40
Woody fibre (cellulose)	14·73
[2] Mineral matter (ash)	7·50
	100·00
[1] Containing nitrogen	4·39
[2] Including sand	2·25

"Poor quality and impure. It contains rape.

"J. AUGUSTUS VOELCKER."

Though repeatedly pressed to give the particulars, Major Robertson declined to give the names of the manufacturers, stating that the firm was an old-established one who had a good name, and that he was disposed to accept their explanation as contained in the following letter from the firm:—

"June 28, 1887.

"Since receiving your first letter we have gone thoroughly into the matter, and find that the parcel of seed worked at the time you were last supplied was not altogether satisfactory, as the cakes produced turned out dry and poorer in quality than our usual production. We know you have not had any from us previously that would be of inferior quality, and it is a matter of much regret to us that you should have had this.

"If Dr. Voelcker considers you did not receive money value, we shall be glad to make a concession on this parcel, either upon his estimation or what you in your own judgment consider a fair allowance."

Dr. Voelcker wrote further, pointing out that the explanation given, whilst it might account for the poor quality of the cake, would not account for its impurity. No further information could, however, be obtained.

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2. The Right Hon. Lord Kesteven, of Casewick, Stamford, sent, on May 19, 1887, along with other samples, one of linseed-cake, on which Dr. Voelcker reported:—

"June 8, 1887.

Moisture	13·26
Oil	10·97
[1] Albuminous compounds (flesh-forming matters)	21·67
Mucilage, sugar, and digestible fibre	37·68
Woody fibre (cellulose)	8·89
[2] Mineral matter (ash)	7·53
	100·00
[1] Containing nitrogen	3·47
[2] Including sand	2·69

"The linseed-cake is an impure one, having a disagreeable and bitter taste, and being much mixed with materials of a starchy character.

"J. Augustus Voelcker."

Five tons of this cake had been purchased, at the price of 6*l*. 11*s*. 8*d*. per ton delivered, from Mr. Geo. Shillaker, Market Deeping, agent for Messrs. David Salmond & Son, of Wilmington Oil Mills, Hull. Each cake was branded "D. S. Pure," and was invoiced as such. This lot was a portion of a delivery running from January 1, 1887, over 25½ tons having been purchased up to May 14. In consequence of beasts having done badly, his lordship forwarded the cake for analysis.

Lord Kesteven on August 8 sent a second sample, which was part of a delivery made in January of the same cake and through the same agent. The analysis and report were:—

"August 18, 1887.

Moisture	8·55
Oil	12·17
[1] Albuminous compounds (flesh-forming matters)	22·84
Mucilage, sugar, and digestible fibre	39·93
Woody fibre (cellulose)	9·01
[2] Mineral matter (ash)	7·40
	100·00
[1] Containing nitrogen	3·65
[2] Including sand	2·40

"An impure cake, containing some quantity of rape, together with other impurities of starchy character. It has a decidedly bitter taste.

"J. Augustus Voelcker."

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3. Mr. Thos. S. Radford, of Mount Pleasant, Church Broughton, Derby, sent on July 19, 1887, for opinion, a sample of linseed-cake, which he had bought as pure. Dr. Voelcker advised a full analysis, which was made as follows:—

"September 24, 1887.

Moisture	8·59
Oil	10·50
[1] Albuminous compounds (flesh-forming matters)	23·69
Mucilage, sugar, and digestible fibre	38·38
Woody fibre (cellulose)	11·13
[2] Mineral matter (ash)	7·71
	100·00
[1] Containing nitrogen	3·79
[2] Including sand	2·28

"A very impure cake; the fibre is excessive, and the cake contains quantities both of rape and of starchy bodies.

"J. Augustus Voelcker."

The sample was taken from a 2-ton lot, forming part of a contract for 12 tons, to be delivered between July and December, 1887. It was purchased from dealers near Derby. The cake was invoiced as "D. S. Pure Linseed Cake," each one being branded "D. S. Pure." The price was 6*l*. 12*s*. 6*d*. per ton, delivered. Mr. Radford stated that the manufacturers were Messrs. David Salmond & Son, Hull, adding: "The vendor is a respectable man, and I supposed I was buying pure cake, as it was so stamped."

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4. Mr. A. S. Berry, of Pheasey Farm, Queeslet, Great Barr, near Birmingham, sent, on June 1, 1887, a sample of linseed-cake, on which Dr. Voelcker reported:—

"June 15, 1887.

Moisture	13·20
Oil	11·03
[1] Albuminous compounds (flesh-forming matters)	24·87
Mucilage, sugar, and digestible fibre	31·48
Woody fibre (cellulose)	9·67
[2] Mineral matter (ash)	9·75
	100·00
[1] Containing nitrogen	3·98
[2] Including sand	4·10

"This is an impure cake; it has over 4 per cent. of sand and much starchy admixture and foreign seeds. "J. Augustus Voelcker."

Four tons of this cake had been purchased, at 7*l*. a ton delivered, from Mr. Thomas Bradburn, of Wednesfield, Wolverhampton, the makers being Messrs. Willows, Holt & Willows,

of Hull. The cake was branded "W. H. & W., Pure," and invoiced as "W. H. & W. Pure Linseed Cake (our usual make and quality)." Before the cake was sent for analysis the following correspondence passed between the vendor and the manufacturers:—

"Messrs. Willows, Holt & Willows, Hull. "May 27, 1887.

"Gentlemen,—On the 18th inst. you sent 4 tons of linseed-cake to H. and B. Railway labelled 'Great Barr,' and I invoiced them to my customer as 4 tons of linseed-cake, but he refuses to accept this. I have therefore invoiced them to him as you invoiced them to me. He is going to have them analysed, and I hope that they will come out all right. I do not want my name figuring in the 'Journal.'—Yours faithfully,

"THOS. BRADBURN, *per* R.J.S"

"Willows, Holt & Willows, Oil Mills, Hull:

"Mr. Thos. Bradburn, Wednesfield. "May 28, 1887.

"DEAR SIR,—We have your favour of yesterday, contents of which we note, and have no doubt the analysis will turn out satisfactorily. Of course your friend quite understands we do not sell the W. H. & W. Pures as a 95 per cent. linseed-cake, our price for that description being 30*s.* per ton more money.—Yours faithfully, "W. H. & W."

Subsequently to Dr. Voelcker's report being received, the vendor wrote again to the manufacturers:—

"Messrs. Willows, Holt & Willows, Hull. "June 17, 1887.

"GENTLEMEN,—Please refer to my letter of May 27.

"My customer has had this cake analysed, and I enclose copy of analysis. You will perceive that it is an impure and very dirty cake.

"Dr. Voelcker encloses blank form for my customer to fill up, I presume for publication.

"I am going out to-morrow for a week's holiday, and shall not therefore be in the office next week, or see my customer again until Thursday week. I might just say that he refuses to pay for it, and not only so, but he is *very angry and much annoyed.*

"He was under the impression that your cake was commercially pure and of good value.

"It is very hard lines indeed for a dealer to have his name exposed in the R.A.S.E.'s 'Journal' and papers, coupled with the names of the manufacturers of a bad article, when he is quite an innocent party in the business. —I am, gentlemen, yours faithfully, "THOS. BRADBURN."

A sample of the delivery was, at the makers' request, taken from the bulk and forwarded to Mr. Penney for analysis, and on July 7 they wrote to Mr. Bradburn as follows:—

"Mr. Thomas Bradburn. "July 7, 1887.

"DEAR SIR,—We have received and enclose Mr. Penney's analysis of the sample you sent us, *e.g.*, the 4 tons W. H. & W. Pures to Great Barr. From the analysis it appears this lot is not up to our usual quality, the seed not having been so well screened as it should have been. We are willing

to make an allowance of 5*s.* per ton, which will fairly meet the difference in value.—Yours faithfully, "WILLOWS, HOLT & WILLOWS."

"Chemical Laboratory, 11 High Street, Hull:
"July 7, 1887.

"CERTIFICATE OF ANALYSIS.

"FROM M. D. PENNEY, F.C.S.

"SAMPLE.—Linseed-cake, marked 'W. H. & W. Pure, Great Barr,' received July 5, from Messrs. Willows, Holt & Willows.

Moisture	11·24
Oil	10·20
Albuminous compounds	25·70
Mucilage, &c.	34·46
Woody fibre	8·32
Ash	10·08
	100·00
Nitrogen	4·06
Equal to ammonia	4·93

"This is linseed-cake of fairly good quality, except that the ash is too high. M. D. PENNEY."

Mr. Berry did not accept the offer of 5*s.* a ton reduction, but paid the amount in full, adding that he considered Mr. Bradburn blameless in the matter, and did not wish his name mentioned.

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5. Mr. Berry, on June 21, 1887, sent another sample of linseed-cake, six tons of which had been purchased, at 7*l.* a ton delivered, from Mr. J. K. Bourne, of Atherstone, the cakes being invoiced to him as "Pure Linseed-Cake," and branded "W. H. & W. Pure," the makers being Messrs. Willows, Holt & Willows, Hull. The report on this was:—

"July 6, 1887.

Moisture	11·32
Oil	8·47
[1] Albuminous compounds (flesh-forming matters)	27·25
Mucilage, sugar, and digestible fibre	35·08
Woody fibre (cellulose)	10·40
[2] Mineral matter (ash)	7·48
	100·00
[1] Containing nitrogen	4·36
[2] Including sand	2·09

This s an adulterated cake, of low quality; it contains a quantity of ape mixed with it. "J. AUGUSTUS VOELCKER."

The makers, as in the previous case, requested a sample to be forwarded, which was done. The following copy of certificate was handed to Mr. Berry by Mr. Bourne:—

"[Copy.]

"Chemical Laboratory, 11 High Street, Hull:
July 23, 1887.

"Certificate of Analysis.

"From M. D. Penney, F.C.S.

"Sample, 'W. H. & W. Pure' L. Cake, received July 20, from Messrs. Willows, Holt & Willows:—

Moisture	11·44
Oil	9·12
Albuminous compounds	28·35
Mucilage, &c.	36·21
Woody fibre	7·72
Ash	7·16
	100·00
Nitrogen	4·48
Equal to ammonia	5·44

"This is excellent L. Cake. (Signed) M. D. Penney."

On inquiry, Dr. Voelcker ascertained that the reference sample had not been marked or sealed in any way to secure its identification with the cake referred to in the case in dispute.

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6. Mr. H. Mellish, of Hodsock Priory, Worksop, forwarded on August 9, 1887, for analysis, a sample of linseed-cake. On this Dr. Voelcker reported:—

"August 18, 1887.

Moisture	11·45
Oil	13·67
[1] Albuminous compounds (flesh-forming matters)	33·53
Mucilage, sugar, and digestible fibre	26·50
Woody fibre (cellulose)	8·43
Mineral matter (ash)	6·42
	100·00
[1] Containing nitrogen	5·36

"A high analysis, but not a pure cake—it contains rape.

"J. Augustus Voelcker."

Two tons had been purchased, at 8*l.* 3*s.* 4*d.* per ton delivered, from the Agricultural and Horticultural Association, Creek Road, Deptford, being described as "One and All" English-made linseed-cakes, guaranteed pure and to contain 11 per cent. of oil; and Mr. Mellish added that the cakes were made for the Association under a contract. It subsequently transpired that the makers were Messrs. Willows, Holt & Willows, of Hull. Mr. Mellish complained to the Association, who sent down a representative to draw fresh samples. The following letter explains the rest of the transaction:—

"The Agricultural and Horticultural Association, Limited,
Creek Road, Deptford, S.E.:
"November 24, 1887.

"DEAR SIR,—I have much pleasure in giving you all the details respecting the supply of cakes to Mr. Mellish.

"In accordance with the objects of our Association, and to ensure purity of supply for our members, it is our custom to make contracts with leading manufacturers to supply us with cakes under a guarantee which has been carefully settled after consideration of all that has been said on the question by yourself and other scientific authorities.

"We have for some time had contracts of this kind with Messrs. Willows, Holt & Willows, the leading manufacturers in Hull.

"The contracts with them have been worded as follows. They only differ from those we have with other makers in being a trifle lower in oil, Messrs. Willows, Holt & Willows being unwilling to go above 10½ per cent. in the guarantee, whilst some of our contractors will guarantee 11 per cent., and some 12 per cent.

"TERMS OF CONTRACT.

"'One and All' Pure Linseed Cake guaranteed 95 per cent. purity. The average proportion of oil to be not less than 10½ per cent., and sand not exceeding 2 per cent.

"We have paid Messrs. Willows, Holt & Willows on the average quite 30*s*. per ton extra price over their own 'pure' cakes for 'One and All' quality made for us under these contracts, and, as a safeguard for our members, we have required the cakes to be stamped with our brand of 'One and All' to keep them from getting mixed, &c. We have allowed the contractors to send out the cakes direct to our members, but have kept analysing deliveries at irregular intervals to keep a check on the make.

"These safeguards have appeared to us to suffice until the present case, as we have had only one previous complaint, and that did not appear to us to be proved upon investigation by our 'Complaints Committee.'

"In the present case, so soon as we heard from Mr. Mellish, we sent down at our own cost to have sealed samples mutually drawn. Of these we sent one lot to Messrs. Willows, Holt & Willows, and retained the second ourselves for test by you. A third set we have still here unopened.

"Messrs. Willows, Holt & Willows had the cakes analysed by Mr. Penney, of Hull, and sent us the following report by him, which they thought we ought to accept as satisfactory:—

"ANALYSIS.

"Sample linseed-cake (two pieces), marked 'One and All Pure,' received September 30 from Messrs. Willows, Holt & Willows:—

Moisture	10·60
Oil	13·32
Albuminous compounds	31·90
Mucilage, &c.	30·38
Woody fibre	8·04
Ash	5·76
	100·00
Nitrogen	5·04
Equal to ammonia	6·12

"This is a very fine linseed-cake, high in oil and albuminous compounds, and low in ash.

(Signed) "M. D. PENNEY."

"Our Complaints Committee, upon considering the terms of Mr. Penney's report, did not think it was satisfactory, and instructed me to go personally to Hull to see both him and the makers. We also had the reserved sealed sample analysed by yourself, with the result of a report as follows:—

"ANALYSIS.

"Sample of linseed-cake sealed 'Agricultural and Horticultural Association,' and a crest.

Moisture	9·25
Oil	13·43
[1] Albuminous compounds (flesh-forming matters)	33·75
Mucilage, sugar, digestible fibre, &c.	28·68
Woody fibre (cellulose)	9·14
Mineral matter (ash)	5·75
	100·00
[1] Containing nitrogen	5·40

"We have made a careful examination of this cake; the analysis is a remarkably high one, but the cake contains rape, and is therefore not a pure one. (Signed) "AUGUSTUS VOELCKER & SONS."

"The result of my visit to Mr. Penney was that he pointed out he had not passed the cakes as 'pure,' although he had spoken of them highly in other respects. I arranged with him that in all analyses for us the word 'pure' should never be used except as meaning cakes coming up to the standard of 95 or 96 per cent. purity.

"The result of my interview with Messrs. Willows, Holt & Willows was that they would only give their general belief that the cakes were made from seed equal to 95 per cent. purity after passing the screens, and that if any default had been made it was accidental, and they would allow for it. I then arranged that in future notice should be given to our representative in Hull of each lot crushed for us, and that each lot shall in future be sampled and analysed before it leaves the mill.

"We have written Mr. Mellish proposing to allow him the difference between 'One and All' pure cakes and ordinary 'pure' cakes (so-called), which we estimated at 30*s.* to 40*s.* per ton, or to allow him whatever other difference your judgment may think fair.

"If your Chemical Committee can suggest any other measures which can be taken by our Association to give practical effect to their recommendations, we shall feel obliged for them, as our first and chief object is to obtain reliability of supply for our members. You will see that in this case we have not hesitated about expense or trouble to bottom the facts and find a remedy for the complaint.—Yours faithfully,

"EDWD. OWEN GREENING, Managing Director.

"Dr. J. Augustus Voelcker, Consulting Chemist, Royal Agricultural Society, 12 Hanover Square, W."

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7. Mr. M. Blair sent on August 26, 1887, on behalf of Lord Bolton, Bolton Hall, Bedale, a sample of linseed-cake for analysis, and the following report was given:—

"September 5, 1887.

Moisture	13·89
Oil	12·43
[1] Albuminous compounds (flesh-forming matter)	29·81
Mucilage, sugar, and digestible fibre	29·05
Woody fibre (cellulose)	8·73
Mineral matter (ash)	6·09
	100·00
[1] Containing nitrogen	4·77

"This cake is not a pure one; it contains cockle and other foreign seeds in some quantity. "J. Augustus Voelcker."

Two tons of this cake had been purchased from a dealer at Bedale, the makers being Messrs. Willows, Holt & Willows, Hull, and the cakes were branded "W. H. & W. Pure," and invoiced accordingly. The price was 7*l*. 5*s*. per ton delivered. No application was made for a reduction.

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8. Mr. W. H. Grimes, of Bubbenhall, near Kenilworth, sent on September 17, 1887, a sample of linseed-cake for analysis, on which Dr. Voelcker reported:—

"September 24, 1887.

Moisture	11·11
Oil	10·43
[1] Albuminous compounds (flesh-forming matters)	27·94
Mucilage, sugar, and digestible fibre	33·08
Woody fibre (cellulose)	9·73
[2] Mineral matter (ash)	7·71
	100·00
[1] Containing nitrogen	4·47
[2] Including sand	2·60

"An impure cake; contains rape in some amount.

"J. Augustus Voelcker."

The cake was invoiced as "Pure Linseed-Cake" at 7*l*. 5*s*. a ton. Three tons had been purchased from dealers, the makers being Messrs. Willows, Holt & Willows, of Hull, and each cake was branded "W. H. & W. Pure."

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9. Mr. R. F. Shackel, of West Hyde Lodge, Rickmansworth, sent for analysis, on November 5, 1887, a sample of linseed-cake which he had purchased as pure. The report on this was:—

"November 10, 1887.

Moisture	13·38
Oil	9·80
[1] Albuminous compounds (flesh-forming matters)	26·19
Mucilage, sugar, and digestible fibre	34·79
Woody fibre (cellulose)	9·30
Mineral matter (ash)	6·54
	100·00
[1] Containing nitrogen	4·19

"This is not a pure cake at all. J. Augustus Voelcker."

Three tons of this cake had been purchased from Mr. John Parkhouse, Rickmansworth, the makers being Messrs. Willows, Holt & Willows, of Hull, and the word "Pure" was branded on each cake. Mr. Shackel wrote:—

"November 28, 1887.

"DEAR SIR,—Respecting the linseed 'pure' cake, I wrote to Messrs. Willows, Holt & Co., informing them I had had their cake analysed, and the report was it was impure. On November 25 I heard from them, asking me to send them a sample of the cake, which I have done. They informed me that Mr. Parkhouse was not their agent, but a merchant who bought direct from them, and that they sold a 'special' cake guaranteed 95 per cent. pure.—Believe me, yours truly, "R. SHACKEL."

"Dr. Voelcker."

"December 3, 1887.

"DEAR SIR,—I enclose you the analysis made by Dr. Baynes for Willows, Holt & Co.; also his remarks. W., H. & Co. state that their circulars state that they make a higher quality from linseed of 95 per cent. purity, at 22*s*. 6*d*. per ton more money. I wrote to them to say that did not do away with their word 'Pure,' and I had bought cake at the same time with better analysis at 10*s*. per ton less money.—Yours truly,

"Dr. Voelcker." "R. SHACKEL."

"ANALYSIS OF W. H. & W. PURE CAKE.

Moisture	14·28
Oil	9·97
[1] Albuminoids	26·58
Digestible fibre	33·02
Woody fibre	9·50
Ash	6·65
	100·00
[1] Containing nitrogen	4·20

"This cake is of excellent value for feeding purposes. It contains nearly 70 per cent. of readily assimilable matter; the oil and albuminoids are in good proportion, whilst its woody fibre is low. It is in capital condition, and easy of digestion. "JAS. BAYNES."

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10. Messrs. Bolam & Carnac, of Palace Chambers, Westminster, sent on June 16, on behalf of Mr. Chas. Hoare, of Saynden Farm, Staplehurst, Kent, a sample of linseed-cake for analysis. On this Dr. Voelcker reported:—

"July 1, 1887.

Moisture	12·71
Oil	14·14
[1] Albuminous compounds (flesh-forming matters)	24·81
Mucilage, sugar, and digestible fibre	31·92
Woody fibre (cellulose)	9·10
Mineral matter (ash)	7·32
	100·00
[1] Containing nitrogen	3·97

"This cake is not pure. It has a bitter taste, and, on examination, I find it contains some rape-seeds. "J. AUGUSTUS VOELCKER."

Ten tons had been purchased, at 7*l.* a ton, from the Oil Seed Crushing Company, Limited, Dover, who were the manufacturers, the delivery being guaranteed pure, and to contain 12 per cent. of oil. Five shillings a ton allowance was made and accepted.

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11. Mr. C. Mannington, of Park House, Northiam, Sussex, forwarded, on June 25, 1887, a sample of linseed-cake for analysis, on which the report was:—

"July 6, 1887.

Moisture	12·70
Oil	13·87
[1] Albuminous compounds (flesh-forming matters)	26·37
Mucilage, sugar, and digestible fibre	30·93
Woody fibre (cellulose)	8·93
[2] Mineral matter (ash)	7·20
	100·00
[1] Containing nitrogen	4·22
[2] Including sand	2·30

"A cake having a bitter and unpleasant taste, and containing rape and other impurities. "J. AUGUSTUS VOELCKER."

Four tons 5 cwts. had been purchased, at 7*l.* 5*s.* a ton delivered, from Mr. Albion Thorpe, Battle, Hawkhurst, the cake being invoiced as "Dover Pure." The makers, who were the Oil Seed Crushing Company, Dover, asked for samples of the cake, and these were sent. On September 12 Mr. Mannington wrote:—

"Dr. J. A. Voelcker. "September 12th, 1887.

"LINSEED-CAKE.

"DEAR SIR,—In reply to yours of the 8th inst., Mr. Thorpe has agreed to allow me ten shillings per ton on the cake in dispute. I have not yet had the invoice, as we have not settled our account.

"The makers own 'that their men must have mixed other than linseed by mistake.'—Truly yours, "CHARLES MANNINGTON."

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12. Mr. Isaac Mannington, of Court Lodge, Ewhurst, Hawkhurst, sent a sample which he described as linseed-cake, writing on July 25, 1887:—

"DEAR SIR,—I bought the sample of cake sent you for 'Pure Linseed' cake—'Dover cake'—but, not liking its appearance, sent it you. I give 7*l.* 5*s.* per ton for 20 tons.

"Please forward the analysis, and oblige,—Yours truly,

"Dr. J. A. Voelcker." "ISAAC MANNINGTON."

Dr. Voelcker reported:—

"July 28, 1887.

Moisture	10·42
Oil	11·37
[1] Albuminous compounds (flesh-forming matters)	32·06
Mucilage, sugar, and digestible fibre	30·45
Woody fibre (cellulose)	6·37
[2] Mineral matter (ash)	9·33
	100·00
[1] Containing nitrogen	5·13
[2] Including sand	3·54

"This is not linseed-cake at all, but *mustard*-cake.

"J. Augustus Voelcker."

Mr. Mannington wrote on September 12:—

"Sir,—In reply to yours at hand. On inquiry, it was found there were a few mustard-seed cakes put in the linseed-cakes by mistake.—Yours truly,

"J. A. Voelcker, Esq." "Isaac Mannington."

Dr. Voelcker was not able to obtain further particulars, nor a reply to his inquiry as to how many cakes were linseed and how many mustard, though he pointed out how serious the mistake might have been had the cakes been used.

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13. Mr. Montague Kingsford, of Littleborne, near Wingham, Kent, sent on October 29, 1887, a sample of linseed-cake for analysis. The report was as follows:—

"November 4, 1887.

Moisture	13·53
Oil	12·60
[1] Albuminous compounds (flesh-forming matters)	24·48
Mucilage, sugar, and digestible fibre	33·30
Woody fibre (cellulose)	8·70
[2] Mineral matter (ash)	7·39
	100·00
[1] Containing nitrogen	3·92
[2] Including sand	2·44

"This is a cake showing a very high degree of adulteration, and possessing a bitter taste. "J. Augustus Voelcker."

This was taken from a lot of four tons, forming the first portion of a contract for twenty tons, which had been guaranteed as pure and to contain 12 per cent. of oil. It was invoiced as pure, the vendor being Mr. Frederick Elgar, of Rochester, and the makers, the Oil Seed Crushing Company, Dover. The price of it was 7*l*. 10*s*. a ton delivered. This cake contained a quantity of rape, also mustard and other foreign seeds. Ultimately 26*l*. was paid for the four tons.

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14. Mr. H. Potter, of Bestwood Park, Arnold, Notts, sent on July 1, 1887, a sample of linseed-cake for opinion as to its purity. On Dr. Voelcker reporting that he believed it to be impure, and advising a full analysis, this was made, and the following report sent:—

"July 19, 1887.

Moisture	12·25
Oil	11·81
[1] Albuminous compounds (flesh-forming matters)	26·94
Mucilage, sugar, and digestible fibre	32·12
Woody fibre (cellulose)	8·03
[2] Mineral matter (ash)	8·85
	100·00
[1] Containing nitrogen	4·31
[2] Including sand	3·55

"This cake has a good deal of rape-seed in it, together with other foreign seeds, also 3½ per cent. of sand. "J. AUGUSTUS VOELCKER."

One ton of this had been purchased from Messrs. F. White & Son, of Retford, at 7*l.* a ton delivered (5*s.* discount), the cake being invoiced and branded as "B. Pure." The makers were Messrs. Walker & Smith, of Hull.

Mr. Potter, in answer to inquiries, reported that up to date he had not been able to obtain any settlement, in consequence of the vendor having gone abroad.

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15. Mr. Charles Walker, of Southfields, Coleshill, near Birmingham, sent, on September 1, a sample of linseed-cake for analysis. Dr. Voelcker's report was:—

"September 24, 1887.

Moisture	10·98
Oil	11·41
[1] Albuminous compounds (flesh-forming matters)	30·25
Mucilage, sugar, and digestible fibre	30·73
Woody fibre (cellulose)	9·69
[2] Mineral matter (ash)	6·94
	100·00
[1] Containing nitrogen	4·84
[2] Including sand	2·01

"A cake adulterated with rape. J. AUGUSTUS VOELCKER."

Mr. Walker purchased four tons of this cake from dealers at Warwick, at 4*l.* 18*s.* 6*d.* a ton delivered, the cakes being branded "B. Pure." The makers were Messrs. Walker & Smith, of Hull, and the cakes were invoiced "W. & S. Pure Linseed-Cake." On November 25, Mr. Charles Walker wrote:—

"Southfields, Coleshill.

"DEAR SIR,—In reply to yours of the 19th in reference to cake, the agent made me an allowance of 10*s*. a ton, although he said the makers quite ignored the matter. I am buying cake now warranted 95 per cent. pure.—I am, faithfully yours, "CHAS. WALKER."

"To Dr. Voelcker, 12 Hanover Square."

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16. Mr. John Morrison, of Bushmead Priory, St. Neots, sent on October 10, 1887, a sample of linseed-cake for analysis. The report given was as follows:—

"October 21, 1887.

Moisture	10·67
Oil	9·40
[1] Albuminous compounds (flesh-forming matters)	26·31
Mucilage, sugar, and digestible fibre	33·60
Woody fibre (cellulose)	9·20
[2] Mineral matter (ash)	10·82
	100·00
[1] Containing nitrogen	4·21
[2] Including sand	5·18

"This cake has far too much sand in it. J. AUGUSTUS VOELCKER."

This cake had been offered to Mr. Morrison at 7*l*. 7*s*. 6*d*. a ton delivered, but on having the above report he declined to purchase.

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17. Mr. Martin Seth-Smith, of Colwood Park, Bolney, Hayward's Heath, sent for analysis on November 4, 1887, a sample of linseed-cake. The report upon this was:—

"November 12, 1887.

Moisture	10·28
Oil	9·71
[1] Albuminous compounds (flesh-forming matters)	30·94
Mucilage, sugar, and digestible fibre	32·73
Woody fibre (cellulose)	8·51
[2] Mineral matter (ash)	7·83
	100·00
[1] Containing nitrogen	4·95
[2] Including sand	2·80

"A cake that has no right to be called pure; it is made from decidedly dirty seed. "J. AUGUSTUS VOELCKER."

This cake contained a quantity of niger-seed, also rape-seed, and some mustard. Mr. Seth-Smith stated that it had been sold to him at the highest market price as pure linseed-cake, from Calcutta seed, 10 per cent. oil guaranteed. Five tons of the cake had been purchased, forming the first part of a contract

for 20 tons, at 7*l.* 1*s.* 3*d.* per ton delivered. It was invoiced as "Pure Linseed-Cake," and described as "Tovil Pure." The makers were Messrs. T. W. Brook & Co., Tovil Oil Mills, Maidstone. On Mr. Seth-Smith complaining, the following letter was received by the vendors:—

"Tovil Oil Mills, Maidstone, November 18, 1887.

"Messrs. * * * * * *

"Dear Sirs,—Yours of the 17th inst. to hand, containing Mr. Smith's complaint about our linseed-cake. The cakes in question were made from Calcutta linseed bought on the 96 per cent. basis, and as you well know some parcels come dirtier than others, and we consider 2·80 sand is not an exorbitant percentage, at the same time we should like to see it less ourselves. As to the percentage of oil, we always reckon on 10 per cent., and the few points under that figure are very slight, and we have no doubt that the bulk would have shown 10 per cent. We consider the cake is what we sold it you for, and we cannot think of admitting any claim.—Yours truly,

"T. W. Brook & Co."

Royal Agricultural Society of England.

1888.

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Royal Agricultural Society of England.

GENERAL MEETING.

12 Hanover Square, Thursday, December 8, 1887.

REPORT OF THE COUNCIL.

The Council have to report that the list of Governors and Members has undergone the following changes during the past half-year:—The deaths of 5 Governors and 78 Members have been recorded, and 40 Members have resigned; on the other hand, 166 New Members have been elected, amongst whom the Council have the gratification of announcing that the name of Prince Albert Victor of Wales is included.

The Society now consists of:—

69 Life Governors,
61 Annual Governors,
3,460 Life Members,
5,417 Annual Members,
16 Honorary Members,

making a total of 9,023, showing an increase of 41 since the meeting in May last.

The Council announce with regret the death of three of the Honorary Members of the Society, Professor Boussingault, of Paris, Professor Solly, of Sutton, and the Hofrath Adolph Stockhardt, of Tharand, Saxony. The Council have elected as an Honorary Member, Professor Charles V. Riley, M.A., Ph.D. of Washington, Entomologist to the United States Department of Agriculture.

The half-yearly statement of accounts to June 30 last has been examined and certified by the Auditors and Account-

ants, and has been printed in the October number of the Journal for the information of Members.

Since the date up to which that statement was made, the Council have found it necessary to sell out the 2,010*l.* 1*s.* 3*d.* Consols, and 4,000*l.* of the New Three per Cents. belonging to the Society (making 6,010*l.* 1*s.* 3*d.* in all), towards meeting the exceptional expenditure which has been incurred during the year. 1,135*l.* of this expenditure represents the cost of New Entrances for the Country Meetings, and about 1,800*l.* the cost of the alterations and improvements in the Society's House. There was a loss of 1,004*l.* in connection with the Spring Show of Stallions which took place at Newcastle in January 1887; and a further loss of about 2,000*l.* in connection with the annual Country Meeting at the same city in July. In addition to the above, a grant of 1,300*l.* to the family of the late Secretary has been made, as reported at the General Meeting in May last.

A Special Committee of the Council, consisting of the Chairmen of the various Standing Committees, is now engaged upon an examination of the expenditure of the Society, and the Council have reason to hope that as a result of its labours considerable economies will be effected.

The attendance at the Newcastle Show was upon the whole satisfactory, although the numbers admitted on the half-crown days fell below expectation, and the closing day (Friday) was marked by inclement weather. On the Thursday, however, the unprecedentedly large number of 77,869 persons paid for admission.

The Exhibition of Stock was in many respects far above the average, and with the exception of the Battersea and Kilburn Meetings, no such completely representative display of British breeds of Live Stock has ever been seen at the Country Meetings of the Society.

The trials of Portable Agricultural Steam Engines, conducted under the superintendence of Sir Frederick Bramwell and Mr. William Anderson, as Consulting Engineers of the Society, were followed with much interest, and the Council have reason to believe that the considerable expense involved in these trials, amounting with the prizes to about 800*l.*, has

been abundantly justified by the results announced in the valuable Report of the Consulting Engineers which appears in the current number of the 'Journal.'

A new feature of the Show was the competition of Shoeing Smiths practising in the district in which the Meeting was held. This competition proved very popular with the trade and with the general public, and the Council are therefore encouraged to hold another contest of the same kind in connection with the Nottingham Meeting next year.

The Stallions which gained the Premiums at the Spring Show of the Society in January last were exhibited at the Summer Meeting, and their owners received the gold medals awarded to them by the Society at the hands of H.R.H. the Prince of Wales, who, with his two sons, honoured the Meeting with his presence on Tuesday and Thursday of the Show-week.

The Council have arranged for a second exhibition of Stallions, which will be held at Nottingham on February 9 and 10, 1888.

The Annual Country Meeting at Nottingham will commence on Monday, July 9, 1888, and close on the following Friday evening. The Implement-yard only will be open on the previous Saturday, July 7.

In connection with the Nottingham Meeting, the Council will offer the following prizes for agricultural implements[1]:—

CLASS 1.—Hay and Straw Presses, worked by Steam power	FIRST PRIZE	£30
	SECOND PRIZE	£20
CLASS 2.—Hay and Straw Presses, worked by Horse power	FIRST PRIZE	£20
	SECOND PRIZE	£10
CLASS 3.—Hay and Straw Presses, worked by Hand power	FIRST PRIZE	£20
	SECOND PRIZE	£10
CLASS 4.—Best Apparatus for Condensing Milk, suitable for use on a farm		£25

To the customary Prizes offered by the Society for Stock to be exhibited at the Nottingham Meeting, the Local Committee has added Prizes for Shire Stallions and Foals, Hunters, Harness Horses and Ponies, Hackneys and Road-

[1] An additional prize of 20*l*. for a Press for Old Hay worked by Hand Power was granted by the Council at its meeting on March 7, 1888.—[ED.]

sters, Dairy Cattle, Shropshire Sheep, Lincoln Sheep and Wool (subscribed by the Lincolnshire Agricultural Society), Butter, and local Hard and Soft Cheeses. Prizes will also be offered by the Shorthorn Society, the Shire Horse Society, and the Hereford Herd Book Society.

Prizes amounting in all to 315*l.* for the best-managed Farms in Nottinghamshire and Lincolnshire have been offered in three classes by the Local Committee. Thirty-five Farms have been entered for competition, and the Judges will commence their inspection in the course of a few days.

The number of samples analysed in the Society's Laboratory during the past year has been 1,615, 1,536 of these being for Members of the Society and 79 in connection with the Woburn experiments and affiliated Societies. The Consulting Chemist's reports have shown that adulteration of Linseed-cakes has been practised to a larger extent than ever before. The passing of the Merchandise Marks Act, 1887, will, however, aid the efforts of the Society in securing that the supply of Linseed and other cakes shall be of a character strictly in accordance with the description or brand given to them.

The Woburn experiments have been conducted as heretofore, and reports of these, as well as of further experiments on Ensilage and on Sheep-feeding, form part of the contents of the Society's Journal.

The experiments of Local Agricultural Societies have been continued for another year by the following Societies:—The Norfolk Chamber of Agriculture, the Royal Manchester Liverpool and North Lancashire Agricultural Society, and the Essex Agricultural Society.

During the past year 342 applications have been received by the Consulting Botanist from Members of the Society, chiefly for information as to the purity and vitality of seeds for pasture. Judging from the samples submitted, the use of Ryegrass as an adulterant of the Fescues has almost disappeared. There remains, however, in some samples a considerable quantity of worthless or injurious seeds, like those of Yorkshire Fog and the Hair grass, especially in the Meadow Fescue. The clovers (chiefly the White or Dutch

and Alsike) are the frequent medium of introducing a large quantity of weeds on the farm. The vitality of the seeds gave a high average, though in some cases it was very low, especially in seeds which are small and have no thick covering to protect them from desiccation, as in Foxtail and the Meadow grasses. Some samples of smooth-stalked Meadow grass did not even germinate ten per cent., though otherwise they were good and clean seeds. Information has been given to Members as to plant diseases, weeds, and injury to Stock from constituents of the pasture, which will be given at length in Mr. Carruthers' Annual Report.

There has been a considerable increase of work in connection with the Entomological section of the Seeds and Plants Diseases Committee. The applications made to the Consulting Entomologist during the year, for information concerning the attack of various insects upon crops, have been over 1,400 as against 1,100 in 1886, proving that cultivators are becoming more interested in these pests, and anxious to be furnished with methods of preservation and remedies against them.

The Report presented to the Society by Professors Robertson and Penberthy on experimental work on Protective Inoculation for Anthrax and Quarter Ill has been received, and is printed in the current number of the 'Journal.' The Council regret that further investigations with regard to the protective value of inoculation for Quarter Ill and other contagious diseases of animals cannot be carried out except by operators individually licensed, and that in consequence of a misunderstanding as to the state of the law on this point, Professor Robertson is at present unable to continue his inquiries.

The Council have had under their anxious consideration the continued prevalence of pleuro-pneumonia, and they have appointed a deputation to wait upon the Lord President of the Council to urge the adoption of more stringent measures for the suppression of the disease, both in this country and in Ireland.

Colonel Picton Turbervill's annual prize of 25*l.* has this year been offered for the best essay on Welsh Dairy

Farming. Three essays were sent in for competition, and the adjudicator has awarded the prize to the essay bearing the motto "Welsh Black Cattle," the author of which is Mr. W. Barrow Wall, of Pembroke.

The examinations for the Society's junior scholarships were held on November 8 and 9. The number of schools from which candidates were entered was larger than in any year since the Junior Examinations were first started in 1874, ten schools sending up pupils, as compared with six in 1886 and 1885, and seven in 1884. Forty-three candidates were entered from these ten schools, but three did not attend. The result of the examination is that 21 competitors obtained sufficient marks to qualify them for a Scholarship, as against 15 competitors in 1886, and 20 in 1885. Of the successful candidates, the first ten in the following list, arranged in order of merit, will receive Scholarships upon complying with the Society's regulations, and the remainder will receive certificates :—

Portsmouth Grammar School	FREDERICK WM. RUSSELL.
Northampton Grammar School	LEWIS HENRY COOKE.
Surrey County School	JOHN RAMSEY BISHOP.
" " "	BARNARD JOHN WATKIN.
" " "	CHARLES F. H. GREENWOOD.
" " "	PETER GREEN.
Portsmouth Grammar School	FRANK ERNEST ROCK.
Bedford County School	FRANCIS JAMES STEWARD.
Ashburton Grammar School	ARTHUR JOHN ELLIS.
Portsmouth Grammar School	WM. CUTHBERT CHILDS.
Northampton Grammar School	SAMUEL WARREN PRICE.
Aspatria Agricultural College	BERNARD MARDEN.
" " "	SOLOMON HOLLIDAY.
" " "	JOSEPH BRIGGS.
Surrey County School	FRANCIS M. SEAL.
Bedford County School	FRANK ROADS.
" " "	WILLIAM HENRY HARE.
Northampton Grammar School	EDWIN COATES.
Ashburton Grammar School	GEORGE PEARSE FOADEN.
Surrey County School	WM. FREDERICK HERBERT.
" " "	JOHN HUTTE BOUWER.

Of the 19 boys who are unsuccessful in getting the minimum number of marks, 3 failed in all four subjects—Agriculture, Chemistry, Mechanics, and Land Surveying: 8 failed in three subjects, 2 in two subjects, 4 in one subject (of whom 3 failed in Agriculture only), and two, though passing in all subjects, did not earn the number of marks qualifying for a certificate.

The Examiners in all the subjects speak favourably of the quality of the papers submitted to them. The Examiner in Chemistry adds that the number of decidedly bad papers is very much smaller than last year, and that as a whole the answers show very fair knowledge.

In consequence of the rapidly increasing work of the Society in all its branches, it has been found necessary to apply the whole of the rooms in the Society's House (with the exception of those sub-let to the Shorthorn Society and the Smithfield Club) to office purposes. The Chemical Laboratory, greatly enlarged and improved, has been transferred to the upper rooms formerly occupied by the late Secretary, and the old laboratory on the ground floor has been converted into a general office for the clerks.

These alterations have left free the front room on the ground floor, which the Council have fitted up as a general waiting and reading-room for Members, a convenience which has been an admitted necessity for a considerable length of time.

By order of the Council,

ERNEST CLARKE,
Secretary.

Royal Agricultural Society of England.

1888.

DISTRIBUTION OF MEMBERS OF THE SOCIETY AND OF MEMBERS OF COUNCIL.

Districts	Counties	Number of Members of Society	Number of Members of Council	Members of Council
A.	Bedfordshire	117	3	Duke of Bedford, K.G., V.P.; C. Howard; James Howard.
	Buckinghamshire	99	—	
	Cambridgeshire	151	2	H. J. Little; J. Martin.
	Essex	209	1	W. Gilbey.
	Hertfordshire	135	1	Sir J. B. Lawes, V.P.
	Huntingdonshire	50	1	W. Wells, T.
	Middlesex	426	1	G. M. Allender.
	Norfolk	332	3	H.R.H. the Prince of Wales, K.G., T.; Hugh Aylmer; Robert Leeds.
	Oxfordshire	135	1	Earl of Jersey.
	Suffolk	188	2	J. E. Ransome; A. J. Smith.
		—1842	— 15	
B.	Cumberland	180	1	S. P. Foster.
	Durham	195	2	Earl of Ravensworth, V.P.; W. T. Scarth.
	Northumberland	248	2	Sir M. White Ridley, V.P.; Jacob Wilson.
	Westmorland	66	1	W. H. Wakefield, V.P.
		— 689	— 6	
C.	Derbyshire	188	2	Hon. E. K. Coke; H. Chandos-Pole-Gell.
	Leicestershire	98	—	
	Lincolnshire	255	3	Sir J. H. Thorold; Rt. Hon. H. Chaplin; W. Frankish.
	Northamptonshire	135	2	Earl Spencer, V.P.; A. Pell.
	Nottinghamshire	227	2	Duke of Portland; J. Hemsley.
	Rutland	19	—	
		— 922	— 9	

DISTRIBUTION OF MEMBERS OF THE SOCIETY—*continued.*

Districts	Counties	Number of Members of Society	Number of Members of Council	Members of Council
D.	Berkshire	150	2	M. J. Sutton; P. E. Crutchley.
	Cornwall	63	—	
	Devonshire	111	2	Sir T. D. Acland, T.; Sir M. Lopes, V.P.
	Dorsetshire	63	1	Viscount Portman, T.
	Hampshire	186	3	Viscount Eversley, V.P.; Sir A. K. Macdonald, T.; J. A. Caird.
	Kent	362	3	R. Russell; C. Whitehead; C. de L. F. De Laune.
	Somersetshire	152	2	Visct. Bridport, T.; R. Neville Grenville.
	Surrey	185	1	G. H. Sanday.
	Sussex	250	3	Duke of Richmond and Gordon, V.P.; H. Gorringe; R. A. Warren.
	Wiltshire	125	1	J. Rawlence.
		1647	18	
E.	Yorkshire	657	4	Earl Cathcart, T.; Earl of Feversham, V.P.; C. Clay; J. D. Dent, T.
F.	Gloucestershire	200	2	Lord Moreton; Col. Kingscote, T.
	Herefordshire	130	1	J. H. Arkwright.
	Monmouthshire	32	1	R. Stratton.
	Shropshire	443	3	A. P. Lloyd; J. Bowen-Jones; W. Sheraton.
	Staffordshire	238	2	Earl of Lichfield, T.; Marquis of Stafford.
	Warwickshire	197	1	P. A. Muntz.
	Worcestershire	181	2	Earl of Coventry; C. Randell.
	South Wales	162	1	Viscount Emlyn.
		1583	13	
G.	Cheshire	289	3	Lord Egerton, T.; Hon. Cecil T. Parker; A. Ashworth.
	Lancashire	460	3	Duke of Devonshire, V.P.; Earl of Lathom, V.P.; T. H. Miller.
	North Wales	217	2	Earl of Powis, T.; C. S. Mainwaring.
		966	8	
Scotland		148		
Ireland		117		
Channel Islands		12		
Foreign Countries		123		
Honorary Members		16		
Members without addresses		101		
		517		

DR. HALF-YEARLY CASH ACCOUNT

	£ s. d.	£ s. d.	£ s. d.
To Balance in hand, 1st July, 1887 :—			
Bankers	297 3 9		
Secretary	59 6 9		356 10 6
To Income :—			
Dividends on Stock		464 9 6	
Subscriptions :—			
Governors' Annual	35 0 0		
Members' Life-Compositions	363 0 0		
Members' Annual	794 1 0	1,192 1 0	
Journal :—			
Sales	72 0 7		
Sale of Pamphlets	9 9 10		
Advertisements	144 12 6	226 2 11	
Chemical :—			
Laboratory Fees (3 Quarters)		300 1 3	
Education :—			
Sale of Insect Diagrams		1 0 5	
Farm Prize Competition :—			
Prizes given by Newcastle Local Committee	475 0 0		
Entry Fees for 1888	47 0 0	522 0 0	
Norwich Meeting		25 6 11	
Total Income		..	2,731 2 0
To Newcastle Meeting		..	15,954 4 2
To Stock :—			
Sale of 2,010*l.* 1*s.* 3*d.* Consols		2,035 3 9	
„ 4,000*l.* New Three per Cents		4,080 0 0	6,115 3 9
To Bankers :—			
Balance due		..	192 4 1
			£25,349 4 6

BALANCE-SHEET,

To Capital :— LIABILITIES.		£ s. d.	£ s. d.
Surplus, June 30th, 1887		38,620 19 3	
Less Surplus of Expenditure over Income during the Half-year, viz. :—			
Expenditure	7,190 17 0		
Income	2,731 2 0	4,459 15 0	
			34,161 4 3
To Excess of new over old valuation of Country Meeting plant and other property		..	2,116 5 0
			36,277 9 3
To Excess of Expenditure over Receipts:—			
Newcastle Meeting		1,978 2 2	
Stallion Show		1,554 6 5	3,532 8 7
			£32,745 0 8

QUILTER, WELTON, & CO., *Accountants.*

FROM 1ST JULY TO 31ST DECEMBER, 1887. CR.

	£ s. d.	£ s. d.	£ s. d.
By Expenditure :—			
Establishment :—			
Salaries, Wages, &c.	1,204 0 0		
House :—Rent, Taxes, Alterations, &c.	2,003 1 3		
Office :—Printing, Postage, Stationery, &c.	317 12 5		
		3,524 13 8	
Journal :—			
Printing and Stitching	775 18 2		
Printing Advertisements	55 16 3		
Postage and Delivery	200 0 0		
Literary Contributions	175 0 0		
Woodcuts	13 7 6		
		1,220 1 11	
Chemical :—			
Salaries	391 13 4		
Apparatus and Chemicals	33 19 9		
Printing, Advertising, and Stationery	17 6 6		
Petty Payments	15 0 0		
		457 19 7	
Veterinary		102 5 0	
Seeds and Plants Diseases :—			
Consulting Entomologist's Salary	50 0 0		
Consulting Botanist's Salary	50 0 0		
		100 0 0	
Education :—			
Advertising	15 7 2		
Scholarships	200 0 0		
Examiners	15 15 0		
		231 2 2	
Farm Prize Competition :—			
Prizes	475 0 0		
Judges	569 9 1		
Gratuities to Farm Servants	9 0 0		
Expenses on account of 1888	134 6 9		
		1,187 15 10	
Sundries		351 18 10	
Norwich Meeting		15 0 0	
Total Expenditure		. .	7,190 17 0
By Newcastle Meeting		. .	16,841 4 2
By Stallion Show		. .	1,112 1 0
By Nottingham Meeting		. .	200 0 0
By Balance in hand, 31st December :—			
Secretary		. .	5 2 4
			£25,349 4 6

31ST DECEMBER, 1887.

ASSETS.	£ s. d.	£ s. d.
By Cash in hand	5 2 4	
By New Three per Cent Stock 25,885*l.* 4*s.* 4*d.* cost *	25,062 13 4	
[Of this, 6,595*l.* is held against unexhausted Life Compositions, and 130*l.* against special prizes.]		
By Books and Furniture in Society's House	3,537 18 1	
By Country Meeting Plant	2,158 0 0	
By Machinery	1,655 15 0	
		32,419 8 9
At Debit of Nottingham Meeting	. .	517 16 0
		32,937 4 9
Less due to Bankers	. .	192 4 1
		£32,745 0 8

* *Value at* $103\frac{1}{4}$ = 26,726*l.* 5*s.* 3*d.*

Mem.—The above assets are exclusive of the amount recoverable in respect of arrears of Subscriptions to 31st December, 1887, which at that date amounted to 1,704*l.*

Examined, audited, and found correct, this 23rd day of April, 1888.

FRANCIS SHERBORN,
A. H. JOHNSON. } *Auditors on behalf of the Society.*

DR. YEARLY CASH ACCOUNT,

	£ s. d.	£ s. d.	£ s. d.
To Balance in hand, 1st Jan. 1887 :—			
Bankers	. .	720 11 2	
Secretary	. .	56 16 6	
			777 7 8
To Income :—			
Dividends on Stock	. .	926 19 1	
Interest on Deposit Account	. .	11 13 11	
Subscriptions :—			
Governors' Annual	240 0 0		
Members' Life-Compositions	907 0 0		
Members' Annual	4,913 10 0		
		6,060 10 0	
Establishment :—			
Rent, &c.	. .	200 0 0	
Journal :—			
Sales	157 14 9		
Advertisements	302 1 11		
Sale of Pamphlets	12 10 6		
Col. Turbervill's Essay Prizes	75 0 0		
		547 7 2	
Chemical :—			
Laboratory Fees	. .	376 6 6	
Education :—			
Sale of Insect Diagrams	. .	2 10 2	
Farm Prize Competition :—			
Prizes given by the Newcastle Local Committee	475 0 0		
Entry Fees for 1888	47 0 0		
		522 0 0	
Norwich Meeting	. .	48 11 4	
Newcastle Meeting	. .	22,351 3 1	
Stallion Show	. .	652 9 0	
Total Income	. .	. .	31,699 10 3
To Stock :—			
Sale of £2,010 1*s.* 3*d.* Consols	. .	2,035 3 9	
„ £4,000 0*s.* 0*d.* New Three Per Cents.	. .	4,080 0 0	
			6,115 3 9
To Bankers :—			
Balance due	. .	. .	192 4 1
			£38,784 5 9

	£ s. d.	£ s. d.	£ s. d.
By Expenditure :—			
Establishment :—			
Salaries, Wages, &c.	1,599 0 0		
House : Rent, Taxes, Alterations, Repairs, &c.	2,369 10 1		
Office : Printing, Postage, Stationery, &c.	733 18 2		
		4,702 8 3	
Journal :—			
Printing and Stitching Journal	1,434 19 6		
Printing Advertisements	115 12 3		
Postage and Delivery	400 0 0		
Advertising	9 14 6		
Literary Contributions	352 10 0		
Prize Essays	50 0 0		
Wood Engravings	30 17 6		
		2,393 13 9	
Chemical :—			
Salaries	750 8 4		
Apparatus and Chemicals	69 13 3		
Printing, Advertising and Stationery	17 6 6		
Petty Payments	33 4 9		
		870 12 10	
Veterinary :—			
Professional Fees	2 5 0		
On account of Investigations	50 0 0		
Grant to Royal Veterinary College	200 0 0		
		252 5 0	
Seeds and Plants Diseases :—			
Consulting Entomologist's Salary	100 0 0		
Consulting Botanist's Salary	100 0 0		
		200 0 0	
Education :—			
Fees to Examiners	52 10 0		
Printing and Advertising	15 7 2		
Scholarships	200 0 0		
Prizes	50 0 0		
		317 17 2	
Farm Prize Competition :—			
Prizes	475 0 0		
Judges	569 9 1		
Gratuities to Farm Servants	9 0 0		
Expenses on account of 1888	134 6 9		
		1,187 15 10	
Gratuity to Mrs. Jenkins	1,300 0 0	1,300 0 0	
Sundries	373 10 10	373 10 10	
Norwich Meeting	..	35 0 0	
Newcastle Meeting	25,119 19 11		
(£ s. d.)			
Less debited to Country Meeting Plant 1,191 14 6			
" " Stallion Show 348 19 5			
" " Nottingham Meeting 317 16 0			
	1,858 9 11		
		23,261 10 0	
Nottingham Meeting	..	517 16 0	
Stallion Show	..	2,152 19 3	
Total Expenditure	..	..	37,565 8 11
By Country Meeting Plant	..	..	1,213 14 6
By Balance in hand, 31st December, 1887	..	..	5 2 4
			£38,784 5 9

Receipts.

	£	s.	d.
Subscription from Newcastle	2,000	0	0
Admissions to Show Yard by Payment	8,348	3	4
Admissions by Season Ticket	776	8	0
Admissions to Stand at Horse Ring	652	17	0
Admissions to Dairy	26	1	0
Sale of Catalogues	582	19	0
Entries in Implement Catalogue	240	0	0
Advertisements in Stock Catalogue	200	17	6
Implement Exhibitors' Payment for Shedding	2,683	13	11
Non-members' Fees for Entry of Implements	129	0	0
Fees for Entry of Live-Stock	853	5	0
Fees for Horse Boxes and Stalls	344	0	0
Fees for Entry of Poultry	90	2	0
Fees for Horse-Shoeing Competition	10	10	0
Premium for Supply of Refreshments	315	0	0
Premium for Cloak Rooms, Lavatories, &c.	60	0	0
Fines for Non-Exhibition of Live Stock	170	0	0
Implement Fines	5	0	0
Sales of Dairy Produce and Guides	70	7	7
	£17,558	4	4
To Balance	2,029	4	7
	£19,587	8	11

EXPENDITURE.

	£ s. d.	£ s. d.
SHOW-YARD WORKS:—		
By Timber and Joinery	4,379 15 1	
„ Ironmongery, 185*l*. 13*s*. 3*d*.; Hurdles, 150*l*. 3*s*. 4*d*.	335 16 7	
„ Paints, Oils, Glass, &c., 77*l*. 11*s*. 6*d*.; Bricks, Lime, and Cement, 46*l*. 4*s*. 6*d*.	123 16 0	
„ Canvas, Felt, Baize, &c.	1,313 3 1	
„ Railway Charges, 319*l*. 5*s*. 8*d*.; Horse Hire, 134*l*. 12*s*. 11*d*.	453 18 7	
„ Insurance, Coals, and Sundries	33 19 3	
„ Postage and Stationery	46 6 7	
„ Wages	2,116 7 2	
„ Superintendent of Works—Salary and Expenses	566 16 0	
„ Depreciation of Plant	493 1 7	
		9,862 19 11
Per Contra:—		
By Materials transferred	249 4 10	
„ Sale of Materials	2,184 19 4	
„ Work for Exhibitors and Purveyors	1,300 0 0	
		3,734 4 2
		6,128 15 9
Judges' Fees.—Implements, 155*l*.; Stock, 564*l*.; Poultry, 27*l*. 14*s*.; Cheese and Butter, 36*l*. 13*s*. 8*d*.; Horse-Shoeing, 40*l*. 10*s*.		823 17 8
Inspectors' Fees.—Veterinary, 85*l*. 10*s*.; Shearing, 21*l*. 10*s*. 6*d*.; Veterinary Assistants, 18*l*. 13*s*.		125 13 6
Police.—Metropolitan		570 8 5
Clerks and Assistants.—Secretary and Stewards, 124*l*. 11*s*. 6*d*.; Bankers, 18*l*. 8*s*. 6*d*.		143 0 0
Foremen and Assistant-Foremen		135 11 3
Yardmen, 308*l*. 8*s*. 10*d*.; Grooms, Foddermen, and Ring Telegraphs, 96*l*. 5*s*.		404 13 10
Superintendent of Turnstiles, Money Changer, and Money Takers, 60*l*. 18*s*.; Doorkeepers, 57*l*. 9*s*. 2*d*.		118 7 2
Stewards' Expenses at Mansion House, &c., 244*l*. 6*s*. 4*d*.; Assistant-Stewards, 48*l*. 4*s*. 2*d*.		292 10 6
Lodgings for Stewards, Assistant-Stewards, Implement Judges, and Veterinary Inspectors and other Officials		253 13 0
Official Luncheons, Refreshments, and Allowances		300 5 5
Catalogues.—Implements, 291*l*. 12*s*. 4*d*.; Stock, 446*l*. 15*s*. 4*d*.; Awards, 44*l*. 16*s*. 6*d*.; Plan of Yard, 29*l*.; Guide to Dairy, 11*l*. 8*s*. 6*d*.; New Packing Cases and Carriage, 49*l*. 14*s*. 2*d*.; Commission, 54*l*. 8*s*.		927 14 10
Printing, 1,138*l*. 3*s*. 9*d*.; Advertising and Bill Posting, 786*l*. 15*s*. 3*d*.		1,924 19 0
Postage, Stationery, Telegrams, Carriage, &c.		187 10 8
Engineering.—Repairs, 101*l*. 10*s*.; Professional Fees, 235*l*.; Engineers and Assistants, 148*l*. 6*s*. 8*d*.; Wages, 110*l*. 2*s*. 3*d*.; Insurance, 9*l*. 3*s*. 9*d*.; Carriage, 36*l*. 1*s*. 9*d*.; Coals, 9*l*. 14*s*. 8*d*.; Ironwork, 27*l*. 0*s*. 5*d*.; Tarpaulins and Petty Payments, 6*l*. 8*s*. 4*d*.		683 7 10
Dairy.—Milk, 63*l*. 18*s*. 6*d*.; Ice, 6*l*. 3*s*. 11*d*.; Dairymaids, 38*l*. 2*s*. 6*d*.; Utensils, &c., 12*l*. 0*s*. 6*d*.; Carriage, 14*l*. 6*s*. 11*d*.		134 12 4
Hay, 215*l*. 13*s*. 8*d*.; Straw, 386*l*. 3*s*. 9*d*.; Green Food, 164*l*. 10*s*. 6*d*.; Stacking, &c. 2*l*. 2*s*.		768 9 11
Trials.—Land, 31*l*. 15*s*., and Miscellaneous, 18*l*. 7*s*. 11*d*.		50 2 11
Horse-Shoeing.—Hire of Forges, &c., 7*l*. 2*s*.; Carriage, 3*l*. 15*s*. 4*d*.; Iron, &c., 15*l*. 14*s*. 10*d*.; Sundries, 3*l*. 12*s*. 6*d*.		30 4 8
Horse and Carriage Hire		148 5 5
Secretary and Official Staff		33 13 10
Poultry Attendant and Food		15 13 3
Telephone, 20*l*.; Fire Engines and Men, 39*l*. 18*s*. 5*d*.		59 18 5
Commissionaires, 40*l*. 2*s*. 6*d*.; Boy Messengers, 10*l*.		50 2 6
Hire of Furniture, 24*l*. 7*s*.; Hire of Chairs, 26*l*. 9*s*. 8*d*.; China, Glass, and Towels, 4*l*. 19*s*.		55 15 8
Jackets and Caps, 8*l*. 14*s*. 2*d*.; Hats for Boys, 4*l*. 18*s*. 7*d*.; Baskets, 1*l*. 2*s*. 6*d*.		14 15 3
Bee Exhibition, 40*l*.; Rosettes, 19*l*. 1*s*. 5*d*.; Badges, 24*l*. 14*s*. 9*d*.; Medals, 5*l*. 8*s*.		89 4 2
Ironmongery, 27*l*. 5*s*. 9*d*.; Moss Litter, Hire of Harmonium, Newspapers, Coals, Corn, Rope, and Petty Payments, 28*l*. 16*s*.		56 1 9
*Prizes.—Stock, 4,110*l*.; Implements, 410*l*.; Poultry, 294*l*.; Cheese and Butter, 172*l*.; Butter-making, 10*l*.; Horse Shoeing, 64*l*.		5,060 0 0
		£19,587 8 11

* Exclusive of 1,446*l*. given through the Newcastle Local Committee; 50*l*. by the Shire Horse Society; 42*l*. by the Clydesdale Society; 50*l*. by the Shorthorn Society; 30*l*. by the Hereford Herd-Book Society; 50*l*. by the Polled Cattle Society; and 50*l*. by the Galloway Cattle Society.

AGRICULTURAL EDUCATION.

ELEMENTARY EXAMINATION OF PUPILS OF MIDDLE-CLASS AND OTHER SCHOOLS.*

Examination Papers, 1887.

A. AGRICULTURE.

November 8, 1887.

(*Three hours allowed.*)

N.B.—*Your place will be determined more by the quality than the quantity of your work.*

I.—THE SOIL.

1. In what ways does Land Drainage (*a*) affect the fertility of a water-logged soil? and wherein (*b*) are irrigation and land drainage alike in their influence and mode of action?

2. Explain in detail the influence as a manure of caustic lime applied to the soil.

3. How may burning a calcareous clay soil increase its fertility?

4. Explain on the one hand (*a*) the benefit of a bare fallow, and on the other (*b*) the possible injury which it may do.

II.—THE CROPS.

5. Explain how a crop taken from the soil may be either restorative or scourging, in its influence on fertility.

6. In what ways may ploughing a green crop into the ground increase the fertility of the soul?

* For the new Regulations for these Examinations, see page xxv.

7. Explain the policy of crop rotations—the advantage of taking grain and green crops after one another in rotation, instead of each in succession, always on its own plot of ground.

III.—LIVE-STOCK.

8. Explain the fertilising influence of the sheep-fold.

9. In what respects do milk selling, butter dairying, and the cheese manufacture, differ in their influence on the fertility of the farm?

10. Considering all England as a farm, carrying an immense head of stock, and receiving annually enormous quantities of imported food and manure, why is it not continually increasing in fertility?

B. ELEMENTARY CHEMISTRY.

November 8, 1887.

(*Three hours allowed.*)

1. What features does water exhibit at the following temperatures—0° C., 4° C., 100° C.? What is meant by the *latent heat* of steam?

2. What are the principal characteristics which distinguish the so-called *metallic* and *non-metallic* bodies? Is the distinction an absolute one?

3. What do you understand by the term *chemical action*? Illustrate your reply by examples.

4. Describe the preparation of Chlorine. What are its principal uses in commerce?

5. The following four salts are given you, viz. Sulphate of Ammonia; Sulphate of Soda; Sulphate of Potash; Sulphate of Magnesia: how would you distinguish between them?

6. Describe the structure of the flame of a candle. Point out the special features of each portion of the flame.

7. Explain the separation of chemical substances by the mode termed *dialysis*. Give an example.

8. Describe very briefly the preparation of metallic Iron from its ores.

9. Give the chemical composition of the following :—Saltpetre ; Quartz ; Lampblack ; Chlorate of Potash ; Glauber's Salts ; Graphite ; Caustic Soda ; Zinc blende ; Bicarbonate of Potash ; Quicksilver.

10. How is Sulphuretted Hydrogen prepared ? Give the principal tests for Sulphides.

C. MECHANICS AND NATURAL PHILOSOPHY.

November 9, 1887.

(*Three hours allowed.*)

1. State what is meant by stable and unstable equilibrium. Give an example of a body in stable equilibrium and of a body in unstable equilibrium.

2. Draw a right-angled triangle A B C, and suppose it capable of moving freely in its own plane round D, which is a point in the hypotenuse A B such that A D is a fourth of A B ; the length of A C is 15 in., that of B C is 12 in. ; a force of 10 units acts from A to C ; find the force acting from B to C required to balance the former force.

3. A B is a lever of the first order, 10 ft. long, capable of turning round a fulcrum (F) 9 ft. from A ; C D is a parallel lever of the second order, 12 ft. long, capable of turning on a fulcrum at C, and carrying a weight of 9,000 lbs. at E, 6 inches from C ; the ends B and D are connected by a vertical link B D ; find the force P which, acting at A, would just support the weight at E ; find also the tension of the link.

4. A thread is fastened firmly by one end to a fixed point A ; it passes over a smooth fixed point B, and carries a weight of 200 lbs. at the other end C ; given that A B is inclined downwards at an angle of 45° to the horizon, find (by construction or otherwise) the pressure on the point B. What is the magnitude of the pull on the point A, and why ?

5. What is meant when the velocity of a body is said to be uniformly accelerated ? If the velocity of a body is uniformly

accelerated, and if at the end of the first second of its motion its velocity is 7 ft. a second, and at the end of the second second its velocity is 10 ft. a second, what will be its velocity at the end of the 10th second of its motion?

6. A force can just support a mass of 5 oz. against gravity; if that force were applied to a body of 4 lbs. perfectly free to move (for instance, if the force were applied horizontally to the body placed on a smooth horizontal table), what distance would it make the body describe from rest in the first three seconds of its motion ($g = 32$)?

7. A cork is tied by a fine thread to the bottom of a vessel; water is poured in, and the vessel filled to such a depth that the thread keeps the cork from rising to the surface; explain why the thread will be in a vertical line, when the water and cork come to rest.

8. State Boyle's Law. A quantity of air, under a pressure of 3 atmospheres, has a volume of $1\frac{1}{2}$ cubic feet; what will be its volume if the pressure is reduced to $2\frac{1}{2}$ atmospheres? What is meant by a pressure of one atmosphere?

9. What is latent heat? Mention any circumstances under which heat becomes latent.

10. The area of a piston of a steam-engine is 2,000 square inches; the length of the stroke is 6 ft.; the mean pressure of the steam is 22 lbs. per square inch; the piston makes 10 strokes a minute; what is the horse-power of the engine? If this engine overcame at the working point a constant resistance of 1,000 lbs., what would be the velocity of the working point? What supposition is tacitly made in your answer?

D. MENSURATION AND LAND SURVEYING.

November 9, 1887.

(*Two hours allowed.*)

1. A B C is a triangle, whose area is 145,000 sq. ft.; the base A B is 575 ft. long; and the angle A is one of 67° 30′; draw the triangle to a scale of 100 ft. to an inch. Note the number of feet in the other sides, and the number of degrees in the other angles.

2. A B C D is a four-sided figure ; A B is 1,270 ft. long, and the following angles are measured, viz., D A B = 123°, C A B = 31° 30′, D B A = 43° 20′, C B A = 135° ; draw the figure to a scale of 500 ft. to an inch, and note the length of the side C D, and of the diagonal A C.

3. A brick measures $8\frac{3}{4} \times 4\frac{1}{4} \times 2\frac{3}{4}$ in. ; if bricks could be stacked quite close and without mortar, how many would there be in a rod of brickwork (*i.e.* $30\frac{1}{4}$ sq. yds., a brick and a half thick) ?

4. A rectangle has two edges horizontal, and its plane inclined at an angle of 25° to the horizon—like the cover of a book lying on a table and kept partly open ; the horizontal edges are 50 ft. long, the others are 30 ft. long ; find, by construction, the inclination of a diagonal to the horizontal plane.

5. Draw a line 4 in. long, and divide it accurately into 15 equal parts.

6. A B is a side of an ornamental piece of water ; at A, where the stream enters, there is a waterfall of 4 ft. ; at B, where the stream goes out, there is a fall of 5 ft. ; at a point C, a little above A, there is a sluice by which the stream can be sent along a semicircular watercourse to D, a point just below B ; from C to D in a straight line is 800 yards ; what is the fall (in inches per hundred feet) of the stream when it is being carried along the semicircular watercourse ? Show, in a sketch drawn to scale, the point of the watercourse which is on the same level as the piece of water.

REGULATIONS AS TO JUNIOR SCHOLARSHIPS.

[*The following new Regulations for these Scholarships were approved by the Council on April* 11, 1888, *and will come into force for the Examinations to be held in November next.*]

1. In addition to the present examinations of advanced students, a more elementary examination is held annually in November by the Royal Agricultural Society.

2. Ten Scholarships of 20*l.* each are offered, on condition that the Scholar remain at School until the end of the summer term in the following year, or spend the ensuing year with a practical agriculturist or a land agent, to be approved by the Education Committee of the Society, or at one of the Agricultural Colleges, *or partly at a School and partly with a practical agriculturist or a land agent or at an Agricultural College.*

3. No Scholarship will be paid until after a formal certificate of good conduct and industry be produced from the head-master of the School, principal of the College, or the practical farmer or land agent with whom the Scholar has complied with the preceding regulation.

4. Candidates for the Scholarships must be between 14 and 18 years of age. No candidate is eligible for examination a second time who has already obtained a Scholarship.

5. Candidates still at School can only be entered for these Scholarships through the head-masters of their respective Schools. Other Candidates must satisfy the Education Committee of their fitness to compete by sending Certificates of Education, or of their having passed any Examinations in connection with the Science and Art Department, or of any University in the United Kingdom.

6. Any head-master intending to enter Candidates for these Scholarships, and any Candidate intending to enter himself, must inform the Secretary of the Royal Agricultural Society of his intention to do so, on or before October 1 in each year. Entries of individual competitors must be made on or before October 15, on forms to be obtained from the Secretary.

7. The annual Examinations will be held in the month of November simultaneously at such Schools as have Candidates, and at the Society's Rooms, 12, Hanover Square, London, W. The Scholarships will be awarded to the boys who obtain the highest aggregate number of marks.

8. The subjects for examination for the Scholarships will be :—1. The Principles of Agriculture, especially with reference to the Rotation of Crops, the Nutrition of Plants and Animals, and the Mechanical Cultivation of the Soil; 2. Chemistry, as applied to Agriculture; 3. Elementary Mechanics, as applied to Agriculture; 4. Land Surveying.

9. The maximum and minimum marks allotted to each subject are as follows :—

	Maximum	Minimum
Agriculture	400	150
Chemistry	200	75
Mechanics	200	75
Land Surveying	100	40

10. A Candidate who does not obtain the minimum number of marks in any of the subjects in which he is examined will be considered as failing in that subject. No Scholarship or Certificate will be granted to any Candidate who fails in any subject, or who does not obtain a total of 450 marks, *i.e.* half the maximum marks for all four subjects.

11. Subject as above, the Scholarships will be awarded to the ten Candidates who obtain the highest aggregate number of marks. A Certificate stating that he has qualified for a Scholarship will also be granted to each Candidate after the first ten, who passes in each subject, and obtains not less than 450 marks in the aggregate.

12. For the conduct of the examination at each School having Candidates, a Local Secretary will be appointed by the Royal Agricultural Society.

Sealed packets of the examination papers will be sent to the Local Secretary; these packets will be opened and distributed to the Candidates in his presence, or in the presence of some one specially deputed by him.

During the time the papers are being answered there will be present the Local Secretary or his deputy, who will, at the end of the time appointed by the examiner for answering, collect the papers, seal them in packets, and forward them to the Secretary of the Royal Agricultural Society.

By Order of the Council,

ERNEST CLARKE, *Secretary.*

12, Hanover Square, London, W.
April 11, 1888.

SYLLABUS OF SUBJECTS

For the Examination of Candidates for the Society's Junior Scholarships.

AGRICULTURE.

Varieties of soil and climate in Great Britain. Tillage operations. Drainage. Rotation of crops. Rotations adapted to different circumstances of soil and climate. Cultivation of cereal crops (wheat, oats, barley). Cultivation of pulse crops (beans, peas). Cultivation of green crops (swedes, turnips, mangolds, potatoes, vetches). Cultivation of artificial grasses. Management of permanent grass. Haymaking and harvesting. General management and feeding of horses. Dairy management. General management and fattening of cattle, sheep, and pigs. Calendar of farm operations.

The Examiners will be requested to put the questions relating to the cultivation of the soil in a general form, so that each Candidate may be enabled to answer them with special reference to the agriculture of the neighbourhood of his own school.

CHEMISTRY.

General properties of matter. Weights and Measures. Specific weight. Chemical affinity. Atomicity. Differences between mechanical and chemical combinations. Principal laws of combination by weight and volume.

OXYGEN.—Preparation and properties. Oxides. Combustion. Acids and basic oxides. Ozone.

HYDROGEN.—Preparation and properties. Water. Its electrolysis and composition by weight and volume. Distilled water. Rain water. Spring and well waters. Sea water. Hard and soft water. Clark's "soap-test."

NITROGEN.—The atmosphere. Physical properties of the atmosphere. Its composition. The uses of the different constituents of the atmosphere in relation to animal and vegetable life.

COMPOUNDS OF NITROGEN WITH OXYGEN, especially nitric acid.

NITROGEN AND HYDROGEN.—Ammonia, its properties and preparation. Tests for ammonia. Chloride of ammonium. Sulphate of ammonia. General properties of ammonia salts. Manures containing ammonia.

CARBON.—Different varieties of carbon—Diamond—Graphite—Vegetable carbon—Animal charcoal—their properties and uses. Carbon and oxygen. Carbonic oxide and carbonic acid. Sources of carbonic acid in the atmosphere. Properties. Tests for carbonic acid. Methylene, acetylene, ethylene. (*Compounds of carbon and hydrogen.*) Coal-gas. Structure of flame. Davy's lamp.

CHLORINE.—Preparation and properties. Its uses. Chlorine and hydrogen. Tests for hydrochloric acid. General properties of chlorides.

SULPHUR.—Native and refined sulphur. Properties. Sulphides. Hydric-sulphide. Compounds of sulphur and oxygen, particularly sulphuric acid. Uses of oil of vitriol in agriculture.

PHOSPHORUS.—Preparation and properties. Phosphoric acid. The composition of bones. Minerals consisting mainly of phosphates. Phosphatic manures.

SILICON AND SILICIC ACID.—Different varieties of silicic acid. Soluble silica.

POTASSIUM.—Caustic potash. Carbonate of potash. Wood-ashes. Chloride of potassium. Nitrate of potassium.

SODIUM.—Carbonate of soda. Chloride of sodium. Sulphate of soda. Silicate of soda. Glass.

CALCIUM.—Quicklime. Chalk and limestone, and their uses. Shell-sand. Sulphate of lime. Phosphate of lime.

MAGNESIUM.—Carbonate and sulphate of magnesia.

BARIUM.—Chloride of barium. Sulphate of baryta.

ALUMINIUM.—Alumina. Alums. Clays.

IRON.—Cast iron. Malleable iron. Steel. Oxides of iron. Iron pyrites. Ferrous sulphate. Tests for ferrous and ferric salts.

COPPER.—Sulphate of copper. Tests for copper.

MERCURY.—Oxides of mercury. Chlorides of mercury.

LEAD.—Oxides of lead. Sulphide of lead. Acetate of lead.

ZINC.—Oxide of zinc. Sulphate of zinc.

SILVER.—Silver nitrate.

ARSENIC.—Arsenious acid.

MECHANICS, ETC.

Position of centre of gravity in simple figures—circle, triangle, &c. Properties of the centre of gravity. Stable and unstable equilibrium.

Composition and resolution of forces acting at a point, and conditions of their equilibrium, *i.e.*, parallelogram and triangle of forces.

Relation between two forces holding a body in equilibrium on a fixed axis, *i.e.*, equality of their moments.

Applications to equilibrium of lever, wheel and axle, pulley, toothed-wheels, and of a body resting on a smooth plane, horizontal or inclined.

Friction of plane surfaces, and coefficient of friction.

Newton's three laws of motion. Uniformly accelerated rectilinear motion produced in a body of given mass by a force of given magnitude. Absolute unit of force; gravitation unit of force.

Work and its measurement; foot-pound, foot-poundal.

Relation between work done by power and work done against resistances in a machine moving uniformly.

Energy of a moving particle; equation of work and energy for a particle.

Transmission of pressure through a fluid, and fluid pressure on a body wholly or partially immersed. Applications to find specific gravity of solids and liquids.

Weight, pressure, and elasticity of air. The barometer. Boyle's law.

Applications to suction and forcing pumps, siphon, hydrometers, hydraulic press.

Freezing and boiling points of water and graduation of Thermometers. Solid, liquid, and aeriform states of matter. Unit of heat; specific heat; latent heat. Relation between volume, density, pressure, and temperature of gas. Mechanical equivalent of heat.

Arrangement of parts and mode of action of stationary steam engine—Condenser, parallel motion, eccentric, governor and throttle-valve, crank and fly-wheel. Calculation of horse-power of engine.

N.B.—Candidates are expected to be able to work easy examples and answer questions on the subjects specified in the above Syllabus.

MENSURATION AND LAND SURVEYING.

Construction of triangles from various data with scale and protractor. Determination of area of a triangle when it has been drawn accurately to scale.

Mensuration of rectangular areas; and of other areas so far as it can be effected by drawing them to scale, and dividing them into triangles.

Area and circumference of circle determined from radius, or conversely.

Mensuration of rectangular solids, and of prisms, cylinders, and cones.

To plot from notes a three or four sided field, and to find its area when plotted.

Construction of easy plane scales.

Verniers.

Levelling.

N.B.—Each Candidate should have with him in the Examination a pair of compasses, scale of equal parts, and protractor.

MEMORANDA.

ADDRESS OF LETTERS.—The Society's office being situated in the postal district designated by the letter W, Members, in their correspondence with the Secretary, are requested to subjoin that letter to the usual address.

GENERAL MEETING in London, Monday, May 22nd, 1888, at noon.

COUNTRY MEETING at Nottingham, 9th to 13th July, 1888.

GENERAL MEETING in London, December, 1888.

MONTHLY COUNCIL (for transaction of business), at noon on the first Wednesday in every month, excepting January, September, and October: open only to Members of Council and Governors of the Society.

ADJOURNMENTS.—The Council adjourn over Passion and Easter weeks, when those weeks do not include the first Wednesday of the month; from the first Wednesday in August to the first Wednesday in November; and from the first Wednesday in December to the first Wednesday in February.

OFFICE HOURS.—10 to 4. On Saturdays 10 to 2.

DISEASES of Cattle, Sheep, and Pigs.—Members have the privilege of applying to the Veterinary Committee of the Society, and of sending animals to the Royal Veterinary College, Camden Town, N.W.—(A statement of these privileges will be found on page xxxiii. in this Appendix.)

CHEMICAL ANALYSIS.—The privileges of Chemical Analysis enjoyed by Members of the Society will be found stated in this Appendix (page xxx.).

BOTANICAL AND ENTOMOLOGICAL PRIVILEGES.—The Botanical and Entomological Privileges enjoyed by Members of the Society will be found stated in this Appendix (pages xxxv. and xxxvi.).

SUBSCRIPTIONS.—1. *Annual.*—The subscription of a Governor is £5, and that of a Member £1, due in advance on the 1st of January of each year, and becoming in arrear if unpaid by the 1st of June.

2. *For Life.*—Governors may compound for their subscription for future years by paying at once the sum of £50, and Members by paying £10. Governors and Members who have paid their annual subscription for 20 years or upwards, and whose subscriptions are not in arrear, may compound for future annual subscriptions, that of the current year inclusive, by a single payment of £25 for a Governor, and £5 for a Member. No Governor or Member can be allowed to enter into composition for life until all subscriptions due by him at the time shall have been paid. Governors or Members not resident in the United Kingdom will be required on election to pay the life composition.

No Governor or Member in arrear of his subscription is entitled to any of the privileges of the Society.

PAYMENTS.—Subscriptions may be paid to the Secretary, in the most direct and satisfactory manner, either at the office of the Society, No. 12, Hanover Square, London, W., or by means of postal orders, to be obtained at any of the principal post-offices throughout the kingdom, and made payable to him at the Vere Street Office, London, W.; but any cheque on a banker or any other house of business in London will be equally available, if made payable on demand. In obtaining postal orders care should be taken to give the postmaster the correct name of the Secretary of the Society (Ernest Clarke), otherwise the payment may be refused to him at the post-office on which such order has been obtained; and when making remittances it should be stated by whom, and on whose account, they are sent. Cheques should be crossed "London and Westminster Bank."

On application to the Secretary, forms may be obtained for authorising the regular payment, by the bankers of individual members, of each annual subscription as it falls due. Members are particularly invited to avail themselves of these Bankers' orders, in order to save trouble both to themselves and to the Society. When payment is made to the London and Westminster Bank, St. James's Square Branch, as the bankers of the Society, it will be desirable that the Secretary should be advised by letter of such payment, in order that the entry in the bankers' book may be at once identified, and the amount posted to the credit of the proper person. No coin can be remitted by post, unless the letter be registered.

NEW MEMBERS.—Every candidate for admission into the Society must be proposed by a Member; the proposer to specify in writing the full name, usual place of residence, and post-town, of the candidate, either at a Council meeting, or by letter addressed to the Secretary. Forms of Proposal may be obtained on application to the Secretary. The Secretary will inform new Members of their election by letter.

*** Members may obtain on application to the Secretary copies of an abstract of the Charter and Bye-laws, of a Statement of the General Objects, &c., of the Society, of Chemical, Botanical, and Veterinary Privileges, and of other printed papers connected with special departments of the Society's business.

Governors' and Members' Privileges of Chemical Analysis.

(Applicable only to the case of Persons who are not commercially engaged in the manufacture or sale of any substance sent for Analysis.)

THE Council have fixed the following rates of Charges for Analysis to be made by the Consulting Chemist for the *boná-fide* and sole use of Members of the Society. Members have also the privilege of sending samples for Analysis on behalf of any farming company of which they may be directors or managers, provided that the substances so sent shall be for use on the farm of the Company and not for sale to other persons. Members of the Society are also allowed to send to the Society's Laboratory for analysis, at the same scale of fees, any manures and feeding stuffs which are to be used by their outgoing tenants, or which they propose to give free of cost to their occupying tenants.

These analyses are given on the understanding that they are required for the individual and sole benefit of the Member applying for them, and must not be used for other persons, or for commercial purposes. Except in case of dispute, the analyses and reports must not be communicated to either vendor or manufacturer. Land or Estate Agents and others sending samples for analysis on behalf of their principals are only entitled to do so when the latter are themselves Members. The names of the principals should in such cases be given.

To avoid all unnecessary correspondence, Members are particularly requested, when applying to the Consulting Chemist, to mention the kind of analysis they require, and to quote its number in the subjoined schedule.

The charge for analysis, together with the cost of the carriage of the specimens (if any), must be paid to the Consulting Chemist at the time of application.

No.		
1.	An opinion of the genuineness of bone-dust or oil-cake (each sample)	2*s.* 6*d.*
2.	An estimate of the value (relatively to the average samples in the market) of sulphate and muriate of ammonia and of the nitrates of potash and soda	5*s.*
3.	An analysis of guano; showing the proportion of moisture, organic matter, sand, phosphate of lime, alkaline salts and ammonia, and an estimate of its value, provided the selling price of the articles to be analysed be sent with it	10*s.*
4.	An analysis of mineral superphosphate of lime for soluble phosphates only, and an estimate of its value, provided the selling price of the article to be analysed be sent with it	5*s.*
5.	An analysis of superphosphate of lime, showing the proportions of moisture, organic matter, sand, soluble and insoluble phosphates, sulphate of lime, and ammonia, and an estimate of its value, provided the selling price of the article to be analysed be sent with it	10*s.*
6.	An analysis, showing the value of bone-dust or any other ordinary artificial manure, provided the selling price of the manure to be analysed be sent with it.	10*s.*
7.	An analysis of limestone, showing the proportion of lime	7*s.* 6*d.*
8.	An analysis of limestone, showing the proportion of lime and magnesia	10*s.*
9.	An analysis of limestone or marls, showing the proportion of carbonate, phosphate, and sulphate of lime and magnesia, with sand and clay	10*s.*
10.	Partial analysis of a soil, including determinations of clay, sand, organic matter, and carbonate of lime	10*s.*
11.	Complete analysis of a soil	£3
12.	An analysis of oil-cake or other substance used for feeding purposes, showing the proportion of moisture, oil, mineral matter, albuminous matter, and woody fibre, as well as of starch, gum, and sugar in the aggregate; and an opinion of its feeding and fattening or milk-producing properties	10*s.*
13.	Analysis of any vegetable product	10*s.*
14.	Analysis of animal products, refuse substances used for manures, &c.	from 10*s.* to £1
15.	Determination of the "hardness" of a sample of water before and after boiling	5*s.*
16.	Analysis of water of land-drainage, and of water used for irrigation	£1
17.	Analysis of water used for domestic purposes	£1 10*s.*
18.	Determination of nitric acid in a sample of water	10*s.*
19.	Examination of Viscera for Metallic poison	£2 2*s.*
20.	Examination of Viscera complete, for metals and alkaloids	£5 5*s.*
21.	Personal consultation with the Consulting Chemist. (The usual hours of attendance, Monday excepted, will be from 11 to 3, but to prevent disappointment, it is suggested that Members desiring to hold a consultation with the Consulting Chemist should write to make an appointment)	5*s.*
22.	Consultation by letter	5*s.*
23.	Consultation necessitating the writing of three or more letters	10*s.*

The Laboratory of the Society is at 12, Hanover Square, London, W., to which address the Consulting Chemist, Dr. J. AUGUSTUS VOELCKER, requests that all letters and parcels (postage and carriage paid) from Members of the Society, who are entitled to avail themselves of the foregoing Privileges, should be directed. Cheques and Postal Orders should be crossed "London and Westminster Bank."

GUIDE TO THE PURCHASE OF ARTIFICIAL MANURES AND FEEDING STUFFS.

Feeding Cakes.

1. *Linseed-cake* should be purchased as "Pure," and the insertion of this word on the invoice should be insisted upon. The use of such words as "Best," "Genuine," &c., should be objected to by the purchaser.

2. *Rape-cake for feeding purposes* should be guaranteed "Pure," and purchased by sample.

3. *Decorticated Cotton-cake* should be guaranteed "Pure," and purchased by sample.

4. *Undecorticated Cotton-cake* should be guaranteed "Pure," and purchased by sample.

N.B.—All feeding cakes should be purchased in good condition, and the guarantee of the vendor should be immediately checked by a fair sample (taken out of the middle of the cake) being at once sent for examination to a competent analytical chemist. The remainder of the cake from which the sample sent for examination had been taken should be sealed up in the presence of a witness, and retained by the purchaser for reference in case of dispute.

Artificial Manures.

1. *Raw or Green Bones or Bone-dust* should be purchased as "Pure" Raw Bones guaranteed to contain from 45 to 48 per cent. of tribasic phosphate of lime, and to yield not less than 4 per cent. of ammonia.

2. *Boiled Bones* should be purchased as "Pure" Boiled Bones guaranteed to contain from 55 to 60 per cent. of tribasic phosphate of lime, and to yield not less than 1 per cent. of ammonia.

3. *Dissolved Bones* are made of various qualities, and are sold at various prices per ton; therefore the quality should be guaranteed under the heads of *soluble* phosphate of lime, *insoluble* phosphate of lime, and nitrogen or its equivalent as ammonia. The purchaser should also stipulate for an allowance for each unit per cent. which the dissolved bones should be found on analysis to contain less than the guaranteed percentages of the three substances already mentioned.

4. *Mineral Superphosphates* should be guaranteed to be delivered in a sufficiently dry and powdery condition, and to contain a certain percentage of *soluble* phosphate of lime, at a certain price per unit per cent., no value to be attached to *insoluble* phosphates.

5. *Compound Artificial Manures* should be purchased in the same manner and with the same guarantees as Dissolved Bones.

6. *Nitrate of Soda* should be guaranteed by the vendor to contain 95 per cent. of pure nitrate.

7. *Sulphate of Ammonia* should be guaranteed by the vendor to contain not less than 24 per cent. of ammonia.

8. *Peruvian Guano* should be sold under that name, and guaranteed to be in a dry and friable condition, and to contain a certain percentage of ammonia.

N.B.—Artificial manures should be guaranteed to be delivered in a sufficiently dry and powdery condition to admit of distribution by the drill. A sample for analysis should be taken, not later than three days after delivery, by emptying several bags, mixing the contents together, and filling two tins holding about half a pound each, in the presence of a witness. Both the tins should be sealed, one kept by the purchaser for reference in case of dispute, and the other forwarded to a competent analytical chemist for examination.

INSTRUCTIONS FOR SELECTING AND SENDING SAMPLES FOR ANALYSIS.

ARTIFICIAL MANURES.—Take a large handful of the manure from three or four bags, mix the whole on a large sheet of paper, breaking down with the hand any lumps present, and fold up in tinfoil, or in oil-silk, about 3 oz. of the well-mixed sample, and send it to 12, HANOVER SQUARE, W., by post; or place the mixed manure in a small wooden or tin box, which may be tied by string, but must not be sealed, and send it by post. If the manure be very wet and lumpy, a large boxful, weighing from 10 to 12 oz., should be sent either by post or railway.

Samples not exceeding 4 oz. in weight may be sent by post, by attaching two penny postage stamps to the parcel.

Samples not exceeding 8 oz., for three penny postage stamps.

Samples between 8 and 12 oz. can be sent by parcels-post for threepence.

The parcels should be addressed: DR. J. AUGUSTUS VOELCKER, 12, HANOVER SQUARE, LONDON, W., and the address of the sender or the number of mark of the article be stated on parcels.

The samples may be sent in covers, or in boxes, bags of linen or other materials.

SOILS.—Have a wooden box made 6 inches long and wide, and from 9 to 12 inches deep, according to the depth of soil and subsoil of the field. Mark out in the field a space of about 12 inches square; dig round in a slanting direction a trench, so as to leave undisturbed a block of soil with its subsoil 9 to 12 inches deep; trim this block or plan of the field to make it fit into the wooden box, invert the open box over it, press down firmly, then pass a spade under the box and lift it up, gently turn over the box, nail on the lid, and send it by goods or parcel train to the laboratory. The soil will then be received in the exact position in which it is found in the field.

In the case of very light, sandy, and porous soils, the wooden box may be at once inverted over the soil and forced down by pressure, and then dug out.

WATERS.—The water, if possible, should be sent in a glass-stoppered Winchester half-gallon bottle, which is readily obtained in any chemist and druggist's shop. If Winchester bottles cannot be procured, the water may be sent in perfectly clean new stoneware spirit-jars, surrounded by wickerwork. For the determination of the degree of hardness before and after boiling, only one quart wine-bottle full of water is required.

LIMESTONES, MARLS, IRONSTONES, AND OTHER MINERALS.—Whole pieces, weighing from 3 to 4 oz., should be sent enclosed in small linen bags, or wrapped in paper. Postage 2*d.*, if under 4 oz.

OILCAKES.—Take a sample from the middle of the cake. To this end break a whole cake into two. Then break off a piece from the end where the two halves were joined together, and wrap it in paper, and send by parcel-post. The piece should weigh at least from 10 to 12 oz. If sent by railway, one quarter or half a cake should be forwarded, carriage prepaid.

FEEDING MEALS.—About 3 oz. will be sufficient for analysis. Enclose the meal in a small linen bag. Send it by post.

On forwarding samples, separate letters should be sent to the Laboratory specifying the nature of the information required, and, if possible, the object in view.

Members' Veterinary Privileges.

I.—Visits of a Professor of the Royal Veterinary College.

1. Any member of the Society who may desire professional attendance and special advice in cases of disease among his cattle, sheep, or pigs, should apply to the Secretary of the Society, or to the Principal of the Royal Veterinary College, Camden Town, London, N.W.

2. The remuneration of the Veterinary Surgeon or a Visiting Inspector will be 2*l*. 2*s*. each day as a professional fee, and the charge for personal expenses, *when such have been incurred*, which will in no case exceed one guinea per diem. He will also be allowed to charge the cost of travelling, including railway fare, and one shilling per mile if by road, to and from the locality where his services may have been required. The whole or any portion of these charges may, however, in case of serious or extensive outbreaks of contagious disease, be remitted, so far as the Members of the Society are concerned, at the discretion of the Council, on such step being recommended to them by the Veterinary Committee.

3. The Consulting Veterinary Surgeon or Visiting Inspector, on his return, will report to the Member, and, through the Principal of the Royal Veterinary College, to the Veterinary Committee, in writing, the result of his observations and proceedings with reference to the disease; which Report will be laid before the Council.

4. When contingencies arise to prevent a personal discharge of the duties, the Principal of the Royal Veterinary College may, subject to the approval of the Veterinary Committee, name some competent professional person to act in his stead, who shall be remunerated at the same rate.

II.—Consultations without Visit.

Personal consultation with Veterinary Inspector	10*s*. 6*d*.
Consultation by letter	10*s*. 6*d*.
Post-mortem examination, and report thereon	21*s*. 0*d*.

A return of the number of applications from Members of the Society during each half-year is required from the Consulting Veterinary Surgeon.

III.—Admission of Diseased Animals to the Royal Veterinary College, Camden Town, N.W.; Investigations and Reports.

1. All Members of the Society have the privilege of sending cattle, sheep, and pigs to the Infirmary of the Royal Veterinary College, on the following terms, viz. by paying for the keep and treatment of cattle 10*s*. 6*d*. per week each animal, and for sheep and pigs, 3*s*. 6*d*. per week.

2. A detailed Report of the cases of cattle, sheep, and pigs treated in the Infirmary of the College, or on Farms in the occupation of Members of the Society, will be furnished to the Council quarterly; and also special reports from time to time on any matter of unusual interest which may come under the notice of the Officers of the College.

3. An annual grant of 200*l*. is made by the Society to the Royal Veterinary College in aid of the further development of Cattle Pathology. In order to assist the authorities of the College in making the necessary investigations, members of the Society are particularly requested to send to the College any diseased animals (cattle, sheep, or swine) which they would otherwise destroy as useless, and also any specimens of diseased parts of an unusual character. In the event of living animals being sent, it will be necessary to telegraph to the College at Camden Town the time of their arrival at a London station, so that a van may be sent to meet them. The expense of transit will be defrayed by the Royal Veterinary College.

IV.—Visits of Provincial Veterinary Surgeons.

The following Veterinary Surgeons have been appointed, at different centres in England and Wales, for the purpose of enabling Members of the Society to consult them with regard to the diseases of cattle, sheep, and pigs.

County.	*Name and Address.*
Anglesey	Hugh Jones, Brynarron, Langefni.
Bedford	Henry Crofts, Harper Street, Bedford.
Berks	Henry Allnutt, Thames Street, Windsor.
Brecon	John Price, Brecon.

County.	*Name and Address.*
Bucks	G. A. Lepper, Aylesbury.
Cambridge	G. A. Banham, Downing Street, Cambridge.
Cardigan.	Not yet appointed.
Carmarthen	Ditto.
Carnarvon	R. Roberts, Market Street, Abergele.
Chester	W. Lewis, 1 South Street, Nantwich Road, Crewe.
Cornwall	Thos. Olver, Truro.
Cumberland	John Bell, Lonsdale Street, Carlisle.
Denbigh	R. Roberts, Market Street, Abergele.
Derby	Not yet appointed.
Devon	W. Penhale, Barnstaple.
Dorset	W. Vessey, Weymouth.
Durham	John E. Peele, 8 New Elvet, Durham.
Essex	James Taylor, Vengewell Hall, Wix, Manningtree.
Flint	R. Roberts, Market Street, Abergele.
Glamorgan	Charles Moir, Cardiff.
Gloucester	Professor Nicholson Almond, Royal Agricultural College [Cirencester.
Hants	J. D. Barford, 57 Above Bar, Southampton.
Hereford	W. Good, 30 Mill Street, Ludlow.
Herts	W. Wilson, Berkhampstead.
Hunts	A. T. Sprague, Kimbolton.
Kent	W. A. Edgar, Westfield House, Dartford.
Lancaster	J. B. Polding, Red Lion Street, Burnley.
Leicester	John Wiggins, Market Harbro'.
Lincoln (South)	Captain B. H. Russell, Grantham.
Lincoln (Mid)	Charles Hartley, 4 Norman Place, Lincoln.
Lincoln (North)	J. B. Greswell, Mercer Row, Louth.
Merioneth	Evan Wynne Williams, 1 Queen's Row, Dolgelly.
Metropolis and Middlesex	Royal Veterinary College, Camden Town.
Monmouth	G. Lewis, Monmouth.
Montgomery	James M'Cavin, Montgomery.
Norfolk	[Vacant.]
Northampton	T. J. Merrick, Castilian Street, Northampton.
Northumberland and Westmorland	C. Stephenson, Sandyford Villa, Newcastle-on-Tyne.
Notts	C. Gresswell, Albert Square, Derby Road, Nottingham.
Oxford (North)	Chas. N. Page, Banbury.
Oxford (South)	P. S. Walker, Oxford.
Pembroke	Not yet appointed.
Salop	W. E. Litt, Shrewsbury.
Somerset	T. D. Broad, Broad Street, Bath.
Stafford	Harry Olver, Trescoe, Tamworth.
Suffolk	J. Worsley, Ipswich.
Surrey	J. L. Lupton, Richmond.
Sussex (East)	R. A. Stock, Lewes.
Sussex (West)	I. H. Callow, Horsham.
Warwick	Osborn Hills, Leamington.
Wilts	H. Hussey, Devizes.
Worcester	H. R. Perrins, Upper Butts, Worcester.
York (East Riding)	James Jebson, Yapham Grange, Pocklington.
York (North Riding)	W. Barker, Middlesborough.
York (West Riding)	Joseph Carter, 28 Great Horton Road, Bradford.

Members may obtain the attendance of a Provincial Veterinary Surgeon in any case of disease by paying his travelling expenses (which include railway fares, and 1*s.* per mile if by road, including the return journey), and the cost of his visit, which will be at the following rate, viz. :—

	£	*s.*	*d.*
When the whole day is occupied	1	10	0
When half a day or less is occupied	0	15	0
Personal consultation with Veterinary Surgeon	0	10	0
Consultation by letter	0	5	0
Post-mortem examination and report thereon	1	0	0

A return of the number of applications from Members of the Society during each half-year, embodying a statement of those cases which may be of public interest, is required from each Provincial Veterinary Surgeon. These half-yearly reports should reach the Secretary by the end of May and November respectively.

Members' Botanical Privileges.

The Council have fixed the following rates of charge for the examination, by the Society's Consulting Botanist, of Plants and Seeds, for the *bonâ fide* and individual information and benefit of Members of the Society (not being seedsmen).

The charge for examination must be paid at the time of application, and the carriage of all parcels must be prepaid.

No.		
1.	—A report on the purity, amount, and nature of foreign materials, the perfectness, and germinating power of a sample of seed .	1*s.*
2.	—Determination of the species of any weed or other plant, or of any epiphyte or vegetable parasite, with a report on its habits, and the means for its extermination or prevention	1*s.*
3.	—Report on any disease affecting farm crops	1*s.*
4.	—Determination of the species of a collection of natural grasses found in any district, with a report on their habits and pasture value .	5*s.*

N.B.—The Consulting Botanist's Reports on Seeds are furnished to enable Members,—purchasers of seeds and corn for agricultural or horticultural purposes,—to test the value of what they buy, and are not to be used or made available for advertising or trade purposes.

PURCHASE OF SEEDS.

The purchaser should obtain from the vendor, by invoice or otherwise, a proper designation of the seed he buys, with a guarantee that it contains not more than a specified amount of other seeds, and is free from ergot, or, in the case of clovers, from dodder, and of the percentage of seeds that will germinate.

The germination of cereals, green crops, clovers, and timothy grass should be not less than 90 per cent.; of foxtail, not less than 60 per cent.; of other grasses, not less than 70 per cent.

The Council strongly recommend that the purchase of prepared mixtures should be avoided, and that the different seeds to be sown should be purchased separately.

INSTRUCTIONS FOR SELECTING AND SENDING SAMPLES.

I. Seeds.

In sending seed or corn for examination the utmost care must be taken to secure a fair and honest sample. In the case of grass-seeds, the sample should be drawn from the centre of the sack or bag, and in all cases from the bulk delivered to the purchaser and not from the purchase sample. When bought by sample the whole or part of that sample should be sent.

When it is considered necessary to secure legal evidence, the sample should be taken from the bulk and placed in a sealed bag in the presence of a reliable witness who is acquainted with the identity of the bulk, and care should be taken that the purchased sample and bulk be not tampered with after delivery, or mixed or come in contact with any other sample or stock.

One ounce of grass and other small seeds should be sent, and two ounces of cereals or larger seeds. The exact name under which each sample has been bought should be sent with it.

Grass-seeds should be sent at least FOUR WEEKS, *and clover-seeds* TWO WEEKS *before they are required, and they should not be sown until the report has been received.*

II. Plants.

In collecting specimens of plants, the whole plant should be taken up, and the earth shaken from the roots. If possible, the plants must be in flower or fruit. They should be packed in a light box, or in a firm paper parcel.

Specimens of diseased plants or of parasites should be forwarded as fresh as possible. They should be placed in a bottle, or packed in tinfoil or oil-silk.

All specimens should be accompanied with a letter specifying the nature of the information required, and stating any local circumstances (soil, situation, &c.) which, in the opinion of the sender, would be likely to throw light on the inquiry.

Parcels or letters containing seeds or plants for examination (carriage or postage prepaid) must be addressed to Mr. W. Carruthers, F.R.S., 44 Central Hill, Norwood, London, S.E.

Members' Entomological Privileges.

The Council have fixed the charge of 2*s.* 6*d.* for the determination of the species of any insect, worm, or other animal which, in any stage of its life, injuriously affects farm-crops, with a report on its habits, and suggestions as to the methods of prevention and remedy.

Portions of the plants injured should accompany the specimens of the insects.

All specimens should be sent in tin or wooden boxes, or in quills, so as to prevent injury in transmission.

Parcels or letters containing specimens (carriage or postage paid) must be addressed to Miss E. A. ORMEROD, F.R.Met.Soc., Torrington House, Holywell Hill, St. Albans.

General Privileges of Members.

Free admission to the Show-Yard and to the Grand Stand at the Country Meetings, during the time the Show is open to the public, by tickets issued by the Secretary; Exhibition of Live Stock and Implements at the Country Meetings at a reduced charge; the 'Journals' of the Society which belong to the year for which their subscription has been paid, transmitted by post, free of charge, to their address; analyses of Manures, Feeding Stuffs, &c., made at a reduced charge by the Consulting Chemist (p. xxx.), and examination of Plants and Seeds by the Consulting Botanist (p. xxxv.), and of Insects, &c., by the Consulting Entomologist (see above); the liberty of consulting the books in the Library: leave to report the outbreak of disease among cattle, sheep, and pigs, and to request the personal attendance of one of the Society's Veterinary Inspectors; power of sending cattle, sheep, and pigs to the Royal Veterinary College on payment of a small sum for keep and treatment (p. xxxiii.).

No member in arrear of his subscription is entitled to any of the privileges of the Society.

All Members belonging to the Society are bound to pay their annual subscriptions, until they shall withdraw from it by notice in writing to the Secretary.

'Journal.'—The Parts of the Society's 'Journal' are published half-yearly, and (when the subscription is not in arrear) they are forwarded by post or carrier to Members, or delivered from the Society's office to Members or to the bearer of their written order.

The back numbers of the 'Journal' are kept constantly on sale by the publisher, JOHN MURRAY, 50A Albemarle Street, W.

*** All communications intended for the Society should be addressed to the Secretary, at the House of the Society, 12 Hanover Square, London, W. Replies by Telegraph cannot be sent unless paid for in advance, and cannot be guaranteed in any case.

THE

JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY

OF ENGLAND.

SECOND SERIES.—VOL. XXIV.

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THE

JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY

OF ENGLAND.

SECOND SERIES.

VOLUME THE TWENTY-FOURTH.

PRACTICE WITH SCIENCE.

LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1888.

THESE EXPERIMENTS, IT IS TRUE, ARE NOT EASY; STILL THEY ARE IN THE POWER OF EVERY THINKING HUSBANDMAN. HE WHO ACCOMPLISHES BUT ONE ,OF HOWEVER LIMITED APPLICATION, AND TAKES CARE TO REPORT IT FAITHFULLY, ADVANCES THE SCIENCE, AND, CONSEQUENTLY, THE PRACTICE OF AGRICULTURE, AND ACQUIRES THEREBY A RIGHT TO THE GRATITUDE OF HIS FELLOWS, AND OF THOSE WHO COME AFTER. TO MAKE MANY SUCH IS BEYOND THE POWER OF MOST INDIVIDUALS AND CANNOT BE EXPECTED. THE FIRST CARE OF ALL SOCIETIES FORMED FOR THE IMPROVEMENT OF OUR SCIENCE SHOULD BE TO PREPARE THE FORMS OF SUCH EXPERIMENTS, AND TO DISTRIBUTE THE EXECUTION OF THESE AMONG THEIR MEMBERS.

VON THAER, *Principles of Agriculture.*

CONTENTS OF VOLUME XXIV.

SECOND SERIES.

APPENDIX.

DIRECTIONS TO THE BINDER.

The Binder is desired to collect together all the Appendix matter, with roman numeral folios, and place it at the *end* of each volume of the Journal, excepting Titles and Contents, and Statistics &c., which are in all cases to be placed at the *beginning* of the Volume; the lettering at the back to include a statement of the *year* as well as the *volume*; the first volume belonging to 1839-40, the second to 1841, the third to 1842, the fourth to 1843, and so on.

In Reprints of the Journal all Appendix matter and, in one instance, an Article in the body of the Journal (which at the time had become obsolete) were omitted; the roman numeral folios, however (for convenience of reference), were reprinted without alteration in the Appendix matter retained.

JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

XIX.—*The Principles of Forestry.* By C. E. Curtis, F.S.I., F.S.S., Professor of Forest Economy at the College of Agriculture, Downton, Wilts.

It will, I think, serve to elucidate my remarks on the Principles of Forestry if I define (1) what is meant by the term *Forest*, and (2) what is meant by the term *Timber*.

Mediæval writers define *Foresta* as an open wood, as opposed to the *Parcus* or walled-in wood. In England the term *Forest* originally implied a large tract of open land set apart for the preservation of wild animals, and for sport, and did not necessarily imply the presence of timber. Practically, however, in this country there are no forests at all. In the more modern acceptation of the term it implies a large tract of land set apart for the growth of timber trees; but on account of the limited areas of these tracts in England the term *Wood* more correctly applies. Then, again, we have the term *Plantation*, and this attaches to an artificially reared area of woodland. The term forest nevertheless, notwithstanding its ambiguity, is sufficiently precise to render the meaning of the word *Forestry* clear and decisive. It is comprehensive, and includes both arboriculture and sylviculture—terms often somewhat mixed and confused.

With regard to the term *Timber*, I cannot do better than quote from Woodfall's "Practical Treatise on the Law of Landlord and Tenant." He says, in the 12th edition, page 590:—

"By the term *timber* is meant properly such trees only as are fit to be used in building and repairing houses; thus, oak, ash, and elm trees are considered timber in all places, and under whatsoever circumstances they are grown. But only trees of not less than six inches in diameter or two feet girth (allowing for irregularities of shape) appear to be reckoned or considered as 'timber.'"

"Many descriptions of trees which are not generally considered as timber are so in some places by the custom of the country, being there used for the

purpose of building; thus it has been laid down that horse-chestnuts, limes, birch, beech, asp, walnut trees, and the like, may under such circumstances be deemed timber, and are therefore protected by the law as such. It has been determined that in the county of York birch trees are timber, because they are used in that country for building sheep-houses, cottages, and such mean buildings."

"When beech is admitted to be timber by the custom of the country, the general rule of law applicable to timber trees in general attaches upon it, so as to give it the properties and privileges of timber at twenty years' growth."

These extracts clearly define the meaning of the word timber, and all that it seems necessary to add is, that in practice all kinds of trees which have reached a measure of six inches quarter-girth under the bark are treated as timber, and in the following pages I imply this definition.

It must not be supposed that forestry, in the sense in which I have defined it, is an unknown study in England, or that the value of the knowledge and its application has been altogether ignored. True, it has greatly fallen into abeyance, and private landowners have for many years practically ceased to apply the principles of forestry to their woodland areas; but this has arisen through lack of requirement, brought about by a long-continued era of agricultural prosperity, which led to the complete disafforestment of large tracts for purposes of cultivation in various parts of the country. This suspension of principles, so to speak, has been negatively proved by the fact that, owing to a long era of depression, the necessity for its resuscitation has been so extensively recognised.

I use the term "private landowners" to distinguish them from the Crown lands presided over by the Commissioners of Woods and Forests. The areas under their management, especially the young oak plantations, stand out from the mass of general woodland as examples of the application of those branches which serve to make up the term "true forestry."

Public opinion, so long ago as 1763, when peace was concluded in Paris, began to express itself with regard to the rapid depletion of oak timber caused by the immense drain upon our resources for the building of war vessels. This culminated in the appointment of Commissioners to inquire into the state and condition of the woods, forests, and land revenues of the Crown; who presented their first report in January 1787. This, however, was purely preliminary in its character. In their second report, issued in December of the same year, they say:—

"It was our intention that the woods and forests should have been the subject of our second report; because the abuses which we have discovered to exist in that department, and the importance of preserving and protecting those nurseries of timber for the support of the naval strength of this kingdom, seemed to demand from us the earliest attention. But we found it

indispensably necessary, for enabling us to report the state of the forests with due accuracy, to cause geometrical and descriptive surveys to be made thereof."

In their third report, issued in June 1788, the Commissioners say:—

"We are aware that there have been similar complaints, and apprehensions of a want of naval timber in every age, from very early times; and it may therefore probably be supposed that the danger is not more real now than it has formerly been. It may be imagined that if there be an increased demand for naval timber, as that demand must necessarily add to the price, and thereby give greater encouragement to importation and planting, there can be no reason to apprehend that where industry is so general, and property so secure, as they are in this country, an ample supply will not always be obtained from private property or from general commerce."

They proceed, however, to take exception to this supposition, as will be seen by the following extract from the same report:—

"It will be found, however, that this principle does not hold in the case of naval timber, . . . and our information as to the reality of the general decrease of timber *is too certain to admit of any doubt*" (the italics are mine).

In their eleventh report, issued in 1792, they say:—

"The public interest certainly requires that so extensive and so valuable a part of the landed property of the country should not be suffered longer to continue in its present unproductive state; and that either the plan of management which has been pursued ever since the beginning of the present century, and which has had such destructive effects, should be completely altered, and new regulations established, which may render those forests useful nurseries of timber for the navy; or that they should be sold, and converted to tillage or pasture, so as to add to the produce and population of the kingdom."

In their report of 1793 they say:—

"In our reports on the several forests we have described the management and pointed out the prevailing abuses; and we have proposed such alterations . . . to pave the way to the improvement of each forest."

The system which arose from the above reports began to be carried into effect in the year 1813, and has been kept in view ever since.

In 1812, however, a further report was issued by the then Commissioners in compliance with the Acts of 34th George III., cap. 75, and 50th George III., cap. 65, Part II. of which should be read carefully by all interested in this subject. It dwells almost entirely on the subject of the available supply of oak, and the enormous demand upon it for naval purposes; and arrives at this alarming deduction—that to meet the requirements of the navy on its then scale, a thousand acres of fully developed trees (taking forty to the acre, containing each one load and a half of timber) would be required for each year's use.

Space does not permit a further reference to this interesting report, and I must pass on to the report of the Select Committee issued in 1848.

This report did not advert in detail to the evidence of the witnesses examined, and therefore throws but little new light upon the subject. But the minutes of evidence taken by them are extremely valuable; and this, coupled with the reports of Messrs. Robert and John Clutton and Thomas Neve, not only point conclusively to the genuineness of the inquiry, but to the fact that it paved the way to extensive improvements, and to the planting of large areas of oaks in various parts of England, which stand now as striking proofs of what may be done by an exercise of knowledge and expenditure of capital.

About this period, however, iron began to be used for shipbuilding, which gradually allayed public excitement on the subject; and it is no doubt owing to this that the state of apathy to which I shall allude has arisen.

I have endeavoured, by referring briefly to these reports, to show that England, notwithstanding the present unsatisfactory state of her woodlands, has been in the forefront of forest improvement from a very early period. Nevertheless the subject was first treated scientifically by Germany, and this arose from the increasing scarcity of wood, as in our own case. The outcome, however, in her case was totally different from our own.

Except during the long-continued wars—that is, during the latter half of the eighteenth century to the peace of 1815—public attention has by no means been attracted to forestry. When dealing with agriculture, however, the public mind has been easily and readily impressed because public interest is so closely connected with its welfare. This is proved by the sympathy which has been shown with reference to the widespread destitution brought about by the long-continued agricultural depression. Fall in prices of every kind of agricultural produce has resulted for the time being in something like a panic, but that this will pass away and give place to an era of prosperity is a foregone conclusion. Whether prices will rise, or whether the cost of production will fall to the level of the altered circumstances, is an open question. But the fact remains that in a country possessing such wealth and energy, agriculture cannot become a dead industry, though many look upon it, even now, as moribund.

The principles of agriculture have, however, been so long instilled into the minds of all directly interested in the subject that the agricultural collapse cannot be attributed to the lack of such principles. True, there is room for improvement, room

for the teaching of science, and still further, necessity for its application; but a lack of the knowledge of the vital principles is not the cause of this vast depression. It is, as all know, owing to the importation from abroad of commodities, hitherto grown successfully at home, at a cheaper rate than they can be produced by our more expensive methods. So long as this continues, so long must depression continue.

The same rules and principles, however, do not apply to the growth of timber. Our landowners, though apparently they have failed to recognise it, could still compete favourably with foreign growers if they managed their woodlands on the true principles of forestry. Competition, in fact, in timber is absolutely essential, rendered so by the fact that the home supply is insufficient, and often unsuitable. The amount imported, large as it is, has not reduced the price of home-grown timber below a paying level. This statement may be scouted by many, but is nevertheless true.

It is often asserted that it cannot pay to plant new areas when existing timber cannot be sold at remunerative prices; but upon what basis is this assertion made? The price of timber or other commodity is high or low only as it is compared with some standard; and what standard is to be taken with regard to timber?

The landowner who sells timber which he inherits, sells something whereon he has bestowed little or no labour: he is reaping the benefit of an act of self-denial exercised by some previous owner. If he has succeeded to his inheritance, the only cost to him has been the succession duty on the timber he has inherited; if he has purchased his estate, he has bought the timber at its market value, based on the then existing prices. In the former case the standard is low, and prices below those at present obtainable will leave a fair residue. In the latter case the standard will be the price given. As a rule—and it is a fair one—the waste will more than cover the cost of felling.

Timber, in fact, represents latent, or rather inactive, wealth, whilst it is standing; but by judicious management this state of inactivity may be made accumulative, whereas by neglect of ordinary rules of forestry, waste will assuredly occur.

By latent or inactive wealth is meant not the absence of accretive power, nor the absence of the power of decretion, but that it is dormant or locked up. The state of English woodlands proves, only too conclusively, that landowners have looked upon their wealth in this respect as something which requires no care, and upon which they can draw at will to meet the various demands upon them. Until they can be brought to

realise that the application of the principles of forestry will materially increase this wealth and at the same time yield them a regular yearly income, forestry will not rise above its present low level.

Not only has there been neglect in the management of woodland, but little if any progress has been made towards preventing gradual depletion ; and if steps are not taken to remedy this state of things, actual disafforestment may ensue, as it has already done in Ireland.

The landowner need not fear foreign competition, for there is a barrier which will prevent the price of timber falling below a remunerative standard. That barrier is freight, which will rise with an improvement of trade,—an improvement now taking place—and the recession of supplies from the accessible coast-line. In fact, the price of timber would rise far above what it has been, were it not for the extended use of iron and other materials. This, however, will act only as a restraining influence, and prevent rapid and uncertain fluctuations, which are never desirable nor beneficial.

Most civilised States are now turning their attention to the conservation and extension of their woodlands and forest areas. They have awakened from a long sleep of culpable negligence and indifference, to see that a source of wealth has been recklessly used. They have approached, in fact, to the state of a leaseholder who has created no sinking fund, and whose term is rapidly expiring. It is high time England also awoke from the lethargy she has so long indulged in.

In new colonies this state of things is natural, and no teaching will prevent the same thing occurring again. Early settlers require wood for building and for burning, and naturally settle as near as possible to the supplies, and recklessly cut all they require without a thought for the future. It is only when the supply recedes, and extra labour, and therefore cost, is incurred, that a value attaches to it. Then, and not till then, the authorities step in, and, by judicious laws, preserve what remains.

Foreign supplies have of course prevented a recourse to State interference in this country. There has been no want, no scarcity; therefore public attention has not been drawn to the subject. Even now there is no sign of scarcity; and had it not been for agricultural depression probably nothing would have been heard of the Select Committee on Forestry. The long-continued depression, and the national evils arising from it, have focussed public attention on all matters relating to land produce, and the growth of timber has naturally been looked upon as an important factor.

The attention of landowners, too, has been drawn to the subject owing to the diminution of rents, and the desire to make up deficiencies by drawing upon their woods. This has led to inquiry, which has resulted in the discovery that the woodland area is not so productive as it might be rendered. In other words, land has not been supporting its full amount of timber, neither has it been developing that class and quality which alone will meet with a ready sale. The standard that should be arrived at is the greatest possible amount of timber upon a given space, compatible with natural reproduction, and that of the highest possible quality and dimensions. Anything short of this leaves room for improvement and development.

It may therefore be taken for granted that all the woodlands of England are capable of improvement, for no area has reached this state of perfection. In a few instances, no doubt, present landowners and those who preceded them have grasped this ideal, and have endeavoured to reach it, in which case the woods show signs of improvement.

It is only too evident to those who understand the subject of forestry that the present condition of woodland is lamentable in this country; and that it has arisen through a widespread disregard of the most ordinary rules of forestry is equally evident. In thinning, the best timber has been taken, the ill-conditioned left. Decay has not been checked, pruning has been ignored, trees have been allowed to pass maturity or have been realised before maturity has been reached, young germens have been either recklessly destroyed or allowed to run to waste, the thicket stage has been entirely ignored. In fact, Nature has been left to her own devices, and man has reaped the consequences of his neglect. It was never intended that the earth should yield full increase without aid.

Compare this unsatisfactory state of things with what might have been had true forestry been applied in years gone by. There would have been a regularity in management—a system; natural reproduction would have been studied, and there would have been a succession of timber trees following closely on those realised. There would have been trees in all stages of growth, from seedlings to matured timber. Each acre would have carried its full complement of fine, long, straight-grained timber; any sign of decay brought about by broken branches and other injury would have been artificially stayed, pruning would have been scientifically performed, and final realisation would have been followed by natural or artificial reproduction.

The true spirit of forestry would have penetrated the minds

of even the working foresters without State-aided education. Areas would have been kept intact, not necessarily under fully developed timber, but in some stage of tree growth. There would have been no area lying waste and unproductive. More than this, land not remunerative under the plough would have been planted, and the area of woodland would have largely increased. As it is, notwithstanding the fact that large tracts are lying idle and waste, very little extension of planting is taking place.

It is, however, never too late to mend, and if landowners will only rouse themselves and act, a very different state of things may exist in an early generation. Landowners are not asked to exercise self-denial or to sacrifice anything to benefit the nation directly; they are asked to improve what they possess, and to extend their possession in timber, and indirectly to benefit the nation by adding to its substantial wealth, and by giving work to the unemployed.

True, it may be difficult to find the necessary capital, but this is by no means an insurmountable difficulty. If the capital so found be judiciously expended in the planting of new areas—areas now lying idle—the return is certain; it only becomes uncertain when the work is carried out recklessly and unwisely.

If the foregoing remarks are summarised they will result in a direct indictment against the existing management of our woods and plantations, and in the condemnation of the system of waste so evident in the neglected condition of the timber. To support the conclusions arrived at it is only necessary to turn to the Report of the Select Committee on Forestry, and to the evidence taken by it. In their valuable report (1887) they state: "Your Committee are satisfied that, so far as Great Britain and Ireland are concerned, the management of our woodlands might be materially improved." This of course implies that the present condition is unsatisfactory.

The evidence so ably given by Colonel Pearson in the inquiry held in 1885 and 1886 is most valuable; and although he does not profess to have had much practical experience of home forestry, his foreign experience and the result of his keen observation throw much light upon the question. He does not even claim to possess a scientific knowledge of the subject, and yet he is fully alive to the necessity of teaching it to all would-be foresters and land-agents. His whole evidence condemns the present management of the home woodlands.

Again, M. Boppe, Inspector of French Forests, in his able and interesting "Report on a Visit to the English and Scotch Forests by the Professors and Students from Nancy Forest

School," condemns our system, or rather our want of any system at all. He says:—

"It is, therefore, a matter of regret that, among all the forests visited by us in our travels, there is not a single one suitable for the teaching of sylviculture on that broad basis so essential when the pupils are called upon to apply it in all parts of the globe. In England, as in Scotland, all the woodlands may be arranged in two categories, the one containing plantations too young, recently created by the hand of man, the other containing plantations too old, or too much overworked, to be useful for the purpose. Nowhere did we see a high timber forest formed of really mature trees."

These words surely, if correct, thoroughly condemn the forestry practices of Great Britain. Nevertheless, allowance must be made for his attachment to the French method of natural reproduction.

Next, as to the evidence taken in 1887; and preference is given to the evidence of those who may be called practical witnesses.

Mr. H. A. Britton, manager to the firm of Messrs. Richard Shelton & Sons, timber merchants, Wolverhampton, says in reply to the direct question—

"What is your opinion as to the management of woodlands in those (Herefordshire, Worcestershire, and Oxfordshire) counties?"

"There are exceptions, of course, but generally speaking it is very bad."

Mr. John Macgregor, head forester to the Duke of Athole, says, in reply to the question, "What is your opinion as to the management in Perthshire?"

"It might be better."

Mr. John Clutton says:—

"As regards the large proprietors their woods are well managed. As a general rule the smaller woods are not very well managed."

Mr. Evan Powell, of Llanidloes, in Wales, says:—

"I think that there has been a great deal of injudicious planting from the want of knowledge of trees suitable to the soil, and there has been a great deal of neglect in the management of timber I have seen many estates in England where the timber has been grossly mismanaged, and where an immense loss occurs to the owner through the want of a proper knowledge of forestry."

Sir J. D. Hooker, M.D., K.C.S.I., says:—

"I have observed that they [woodlands] are very much neglected."

These extracts, coupled with the implied testimony which runs through the whole evidence, fully confirm the opinion I have expressed that our woodlands are in a neglected and languishing condition owing to the want of a knowledge of the principles of forestry, and the direct application of it.

The question will therefore naturally arise, How can this

knowledge be obtained? I will first endeavour to show what kind of knowledge is required (what, in fact, is meant by Principles of Forestry); then, how it may be obtained; and finally, how it may be applied, and the beneficial results which may be expected.

There are two classes of knowledge required—namely, scientific and practical. This applies equally to all applied sciences, but vitally to forestry. To possess a knowledge of the natural sciences applicable to tree growth—botany, geology, zoology, entomology, biology, and so forth—is insufficient; and no one possessing a full amount of all or either of them could claim to be a forester. But one who possesses such knowledge, especially if directed to this particular branch of study, and who also possesses a knowledge of those subjects which bear directly upon the application—surveying, levelling, drainage of land, practical agriculture, timber measuring, economic uses of timber, planting, pruning, and final realisation—may fairly claim, if experience be added, to be a really efficient and valuable forester. This, then, is what should be aimed at; this should be the definition of a true forestry education. Limit it in any way and you get imperfection; carry it through in its entirety and you obtain, practically, perfection.

What are the branches of study which may be profitably applied to forestry? First, as to science, or art—the latter is perhaps the more correct expression. For if we take Johnson's definition—science is that which depends on abstract or speculative principles; art is that which depends on practice or performance. This at once shows the impossibility of separating the two. No art can be successfully carried on unless science is embodied in it. Vegetable physiology, descriptive botany, morphology, zoology, entomology, biology (in a modified form), geology, chemistry (purely elementary of course), form what are usually called the *scientific* branches of forestry. A knowledge of our land laws, incidence of taxation, land drainage, surveying, and ordinary field engineering, mechanics, uses of materials, tree nomenclature and identification, practical forest operations, nursery practice, realisation and book-keeping, and such kindred subjects, form what may be termed the *practical* branches of forestry.

It is clear that a knowledge embracing so many subjects cannot be acquired without an expenditure of time and money. Anything, however, short of this will result in a mere superficial acquaintance with a vast and wide-spreading industry. How, then, can this be acquired? It is somewhat strange that the woodlands of England should be in such an unsatisfactory con-

dition, as there is evidence to prove that the true principles of forestry, so to speak, were not wanting in past ages. In fact, it is somewhat extraordinary how well acquainted some of the old writers were with both agriculture and arboriculture. Probably they lived somewhat in advance of their time. Hear what Thomas Tusser, gentleman, says in his "Five Hundred Points of Husbandry," written in the sixteenth century.

For the month of January—

> "In lopping old Jocham, for fear of mishap,
> One bough stay unlopped, to cherish the sap."

For April—

> "Sell bark to the tanner, ere timber ye fell,
> Cut low by the ground, else do ye not well.
> In breaking save crooked for mill and for ships,
> And ever, in hewing, save carpenters' chips."

For August—

> "Hops had, the hop-poles that are likely preserve
> From breaking and rotting, again for to serve;
> And plant ye with alders, willows a plot,
> When yearly, as needeth, mo poles may be got."

These quaint verses show either a trained mind or a shrewd power of observation—a power, by the bye, which should be encouraged, and which is essential to the true elucidation of all cultural subjects.

This course of study is absolutely necessary for those who would be foresters, to fit them for managing large areas of woodland, to ensure the full development of timber, upon which alone rests future success or failure. This course can be obtained by those who can pay for it and who can afford the time. The necessary machinery exists, the teachers exist—it only requires to impress upon landowners the necessity of this special qualification in their agents to set the matter rolling. Let them accept this, and let them require in all future appointments evidence of the possession of this knowledge, and intending agents will obtain it.

No State aid—that is, financial aid—is needed for this class, as it may be taken for granted that both landowners and land-agents can afford to pay the necessary fees. If labouring woodmen must be taught, of which hereafter, then State aid becomes imperative.

First it will be necessary to ask the following question: Is it essential to secure a perfect result that professors should have woods under their control for the purpose of teaching forestry? If this is answered in the affirmative, then State aid must be

sought; but my opinion is entirely against this part of any formulated programme. I consider it not only unnecessary, but absolutely detrimental to any scheme which may be advanced, and I base my opinion upon the following assertions: that an immense amount of teaching requires no ocular demonstration whatever; that a difficulty will be found in the selection of qualified teachers capable of rendering a combined scientific and practical course of instruction; that the time required for the supervision of a large area of woodland would seriously interfere with class teaching; and that the operations upon a circumscribed area, no matter how large, would be stereotyped to a great extent, and not invariably yield the ocular instruction required. Drainage, for instance, could not be taught on a piecemeal system to suit a constant succession of classes; planting and after-treatment must be constant to yield instruction, and the area must be large or the planting unduly limited, if such a fixed area is to be permament. No single area, no matter what size, can contain all the elements of instruction required. It must be remembered that the process of planting is for a practically permanent purpose, and the limit of any area must be sooner or later reached. The processes are not annual as in agriculture.

Now it is beyond dispute that all the branches named can be taught in the class-room—that is, practical forestry from a theoretical point of view can be taught without outside aid; although the liberty of entering at will large areas of woodland would naturally promote the end in view, and assist the professor in his teaching. This privilege, however, could no doubt be secured by private arrangement, or by utilising the New Forest, the Forest of Dean, the woods of Windsor or other Crown demesne.

When this theoretical course has been achieved, the correct plan would be for the student (I am assuming that he possesses the necessary means and time) to spend a further period with some practical forester, and to watch and take part in all the operations. He would enter upon the work with an enlightened and trained mind, with the power of observation on the alert, and emerge from the ordeal a perfect forester. This course of study, then, is open to this class of students—is open now; and no State aid, as far as I can see, will advance it, except so far as I shall presently show.

If, however, the working forester is to be educated specially for the purpose, this class of education will not meet the case. Nothing short of a national forest school, or the teaching of the elementary sciences in our national schools, can possibly satisfy the requirement. No private enterprise—at least unas-

sisted—can bring the course of instruction within reach of such a class. But can any sensible man who understands the subject recommend such a course? In a limited country like this, and in such a limited area of woodland as we possess, men educated in this way could not expect to find employment.

I do not for one moment underrate the value of education, and I believe fairly educated men make the best and most intelligent workmen; but this education should be general and not of a special character. A man with a general education will be more intelligently observant—he will inquire into and find out reasons for this and that operation, and will not work like a machine. The present system of national education is rapidly bringing about this class of men, for those who cannot read and write are yearly becoming more rare.

A man whose duty it is to fell a tree, and who has acquired his knowledge by long experience, cannot be taught better by a professor of forestry; other of his daily duties, purely practical as they are, cannot be taught by theoretical teachers; but an educated man will be able to acquire the knowledge why such and such an order is given, and why such and such an act is to be performed.

Technically educate the landowner and the land-agent, and the knowledge will soon percolate among the men. There is no room in this country for a middle class of woodmen, except such as may rise above the ordinary level by sobriety, honesty, and manual skill. If a system of promotion were encouraged it would do more than anything else to stimulate a knowledge of forestry among the working woodmen.

What would be the result of a national school of forestry? An implied national idea and belief that a large number of woodmen were required. Nothing could be more unfair, I may say unjust, than to spread abroad such a false belief. Many would in times like these enter the school, and leave it to find all their hopes disappointed. In a limited area such as we possess educated working foresters are not required.

I will presently show what the Government may do; but now it will be well to turn again to the evidence given before the Select Committee, and gather from it the opinions of acknowledged authorities on the necessity of a forest education.

Colonel Pearson in 1886 says:—

"I am very strongly impressed with the desirability of doing something to promote forest education in this country; or, rather, to put it in the way of young men who may be desirous of obtaining it. . . . The main object, then, seems to be to provide a certain amount of practical education in forestry to supplement the present generally very useful education given to the land-agent class, and at the same time to teach the wood-bailiffs and

foresters who are employed under their orders in our own private woodlands, not only the elements of sylviculture, but also the best known methods of conducting ordinary forest work, such as planting, thinning, pruning, the management of coppice, and the best way of disposing of the crop, &c."

It may be well to point out that Colonel Pearson lays great stress upon the necessity of a large area of forest land being allotted for the special purpose of teaching, and under the direct control of the professor of forest economy.

M. Boppe, too, lays great stress upon this point. He says :—

"The science of forestry is, however, a science of observation, based upon facts which must be studied both from a practical and theoretical point of view. It is, therefore, absolutely necessary that a forest school should have attached to it a forest which has for some time past been under scientific management, serving, so to speak, as a natural laboratory for experiments, and without which the best theoretical teaching in the world would be of no avail."

Mr. J. C. Rogers, Secretary to the Surveyors' Institution, in his evidence given before the Inquiry in 1885, concurs in the general advisability of instituting a forest school; but modifies the term *school* to a system of instruction which would involve no prolonged residence, and which would terminate with an examination. He also expresses his opinion that a large amount of good would result from such a course. He takes no pessimist view of the knowledge of forestry possessed by land agents, but considers that the knowledge they possess requires gathering up and systematising. In 1886 he dwells strongly in his evidence on the matter being a purely national one, and considers it "hopeless to expect the landowners to expend a large amount of capital in view of remote contingencies."

He then proceeds to lay down his scheme of instruction, which it is not necessary here to follow in detail; but the final report in 1887 proves conclusively that it was practically adopted by the Select Committee. The recommendations of Colonel Pearson, already and hereafter referred to, agree substantially with those of Mr. Rogers, owing no doubt to an interchange of views between them.

Mr. Barron, of the Elvaston Nurseries, says :—

"Your forester ought to be a practical man with a scientific knowledge, and at the same time he should be able to take the tool out of the woodman's hand and show him how to use it."

Could there be more sound common-sense advice given than this? It strikes at the root of the whole matter, and lays before us the ideal forester.

Again, in reply to Dr. Farquharson, he says :—

"First of all, they (the students) ought to become acquainted with the species which are grown in this country, and also the sexes and the mode of raising the seeds."

"Practical knowledge as to the pruning of trees."

"The students ought to have a knowledge of geology, and the suitability of soils."

Mr. Britton says:—

"There is no doubt that a more general knowledge of forest management would tend to prevent those mistakes of planting trees upon soils which do not suit them. . . . The general result I have come to is, that very few land-agents know anything of forestry, or very little. . . . But very few land-agents know anything about the felling of timber."

The Hon. S. Lascelles says:—

"I cannot but think that it would be a good thing that land-agents should have some means of educating themselves in forestry better than they can now; but I can hardly see how what are called woodmen—say men at 30*s.* a week—are to avail themselves of a scientific school, and I hardly think that on most of the estates in England they would have any scope for the exercise of the knowledge they would acquire at a scientific school. . . . I think it would be useful that there should be some means of collecting and of giving information generally upon the subject of the management of woods."

Mr. John Macgregor says:—

"Factors and woodmen are deficient in the knowledge of what trees ought to be planted on suitable soils and when thinning-out ought to commence, and, in fact, the general management of woods altogether."

"Those who have charge of woods ought specially to understand the soils and situations suited for the different varieties of forest trees to be cultivated for profit, and they ought to know the proportions in which these trees ought to be planted, and whether they ought to be planted mixed or pure."

"The insects affecting trees is also a subject which requires to be very much studied."

Mr. John Grant Thomson, head forester of the Dowager Countess of Seafield at Strathspey, says:—

"It would be all the better if there could be a school of forestry. If they had the theoretical as well as the practical part it would be all the better for foresters." (Alluding evidently to head-foresters.)

Mr. William M'Corquodale, head forester to Lord Mansfield, says:—

"I think they could be sufficiently trained as practical foresters without a forest school."

The general idea, however, running through his evidence points to a theoretical knowledge being desirable.

Mr. Dundas, of Arniston, dwells strongly upon the necessity of practical knowledge, but admits that scientific knowledge would stimulate the power and accuracy of observation. He says:—

"The want of accurate observation is a great drawback to foresters and farmers. They have never been taught to use their eyes in matters of

minute detail, especially as to the causes of diseases of wood and the diseases of plants. It is very difficult to get an accurate account of what the man really sees, unless he has gone through a certain amount of training to fit him for accurate observation."

This is a most important statement, coming as it does from one who has evidently acquired the power himself; and it fully agrees with my own often expressed opinion.

Mr. Gilchrist, head woodman to Lord Powerscourt, says:—

"I have a very strong opinion with regard to the scientific instruction that a forester requires. It would have been of great advantage to the country if there had been more of it years ago. . . . Of course, as regards the working forester, if he means to remain a working forester all his days, do not let him bother his head about science; but if he wants to improve his position and become a really scientific and practical forester, let him take advantage of that scientific education."

Mr. John Clutton says:—

"There was no scientific training in my day; when I began life 60 years ago, I had no opportunity of being taught forestry of any kind. All I know I have learned from my practical experience of woods, which has been very extensive."

"I think the land-agents should instruct the lower class of men under them. If a land-agent is well instructed, I think the lower class will acquire from him sufficient knowledge for practical purposes without their going to any school."

Sir J. D. Hooker says:—

"I think that an establishment teaching forestry would be exceedingly useful. . . . I think that a sound elementary acquaintance with five or six branches of science would be very useful to a student of forestry, but not more than a young man could pick up at such a course of instruction as I should contemplate, and as is, I believe, to be obtained at the agricultural colleges. . . . The branches of science I would suggest he should be acquainted with would be meteorology especially, and the organs and tissues of plants, physiological botany, geology, and elementary chemistry."

Here, then, is ample and conclusive evidence that a knowledge of the science of forestry would materially advance the interests of individual landowners, and the nation as a whole.

It seems to me that, with this before us, doubt as to the necessity of such knowledge should be at once dismissed. What remains, then, is to determine upon the course to pursue. The evidence is almost unanimous that landowners and land-agents should be first educated, and that the teaching of woodmen should be left to their enlightened operations. Common sense, too, points to this as the correct course and the correct outcome of a purely practical inquiry.

If the labour of the Select Committee ended here, it would not have been in vain. This irrefragable evidence will stand and bear fruit indirectly if not directly. Further, it is not too much to say that the result of their inquiry up to this

point has already had a marked effect in the development of teaching, and in the desire for instruction.

I have before stated that this instruction can now be obtained by the students at the Agricultural Colleges if they, when they leave, spend a short time on some estate where there is a large area of woodland, managed on approved principles. More, however, may be done by a well-organised series of lectures in London, or some other centre, on the subjects which relate to the principles of forestry already specified. This course of instruction should be coupled with demonstration classes in the Museum of Natural History in Cromwell Road, or at the Museums and Gardens of Kew. There is ample material for instruction in these noble institutions and in many of the provincial museums, but it is unproductive from want of appreciation.

I shall now endeavour to show how, by a course of lectures in London encouraged by a Board of Forestry, the knowledge of forestry may be advanced. London being, as it were, the head-centre, holds out inducements which can be offered by no other centre to the young and forthcoming land-agents, students of the Surveyors' Institution, private pupils, articled clerks, and others. Lecturers on the various subjects are there; the accommodation, museums, exhibitions, &c., are there. Woods, forests, the gardens of Kew, and nurseries are within easy reach; everything, in fact, which is requisite is focussed there.

If the Forest Board recommended by the Select Committee were formed, probably one of their chief functions would be to encourage and promote such a course of lectures, and, further, by offering certificates of merit or diplomas on the passing of a strictly scientific and practical examination, to stimulate the desire to obtain the training.

Such lectures would, I believe, when once started, be largely attended, and would probably become, to a great extent, self-supporting. There need be no establishment—that is, no money for the present need be expended upon bricks and mortar—for many of our learned bodies would, I feel sure, willingly lend their lecture-rooms for the purpose. Knowledge might be further advanced by throwing open to the professors and students at all times, or at certain seasons, the New Forest or other Hampshire forests, the Windsor woodlands, and other Crown areas. Private owners, too, might do much, and probably would, by permitting, under proper control, the classes to enter their woods and inspect the works in progress. Forest nurserymen would willingly, I believe, throw open their nurseries

for a similar purpose. Thus advantages would be concentrated, advantages which must otherwise be sought for far and wide.

I know by my own experience that great ignorance exists upon the most trifling matters relating to forestry, and no teacher who appreciates his task will have the least difficulty in finding in these woods at any season of the year ample material for instruction. There is no need whatever, as I have already stated, for the professor to exercise control over the operations.

The scope of the lectures, to be perfect, must include a full and practical course on reproduction; the impregnation of seed; the preparation of seed, the sowing of seed, and the early treatment of young plants; the transplanting and preparation for planting out; the whole course of planting and after-treatment until the period of final realisation; the difference of treatment between trees planted for commerce and for ornament, or for shelter and specimen purposes.

It must also include a complete and comprehensive course on the diseases of trees and plants—the remedies and prevention. Land-agency subjects, especially as they bear on forestry, must be clearly set forth in practical, not legal, phraseology, so that the untrained mind may receive it.

The natural sciences, especially descriptive botany, vegetable physiology, zoology, entomology, &c., should be lectured upon in a clear and concise manner; confining the course as far as possible, as time would be limited, strictly to their bearing upon the special object in view. I mention this because there is always a tendency, when dealing with wide and comprehensive subjects, to treat them too fully and more exhaustively than time permits. This is natural to the teacher who loves his subject, and the avoidance of it approaches almost to an art.

It must be borne in mind that no such course can be complete. The student will terminate his studies with but little more than a veneer, but with a mind so far trained and cultivated as to be susceptible of those facts and natural laws that govern Nature's plan. The spirit of observation will have been generated, and a knowledge of true forestry will eventually result.

I have always found this a difficulty when sending out young men into the practical world. They are diffident of their own powers, and mistrustful, and do not readily realise the fact that experience alone can complete the work which the teacher has only commenced.

The end and aim of this proposed special course of teaching, by whatever means carried out, will be to improve our present woodlands, and to increase the area by wise and judicious planting of land now waste or unremunerative. I have shown that

this is necessary, manifested by the present unsatisfactory condition of our existing woods and by the inadequate knowledge of forestry in those who own or who manage our landed estates.

It will perhaps be best to lead up to the methods of improvement by showing in detail the defects of our present system. Dealing first with existing woods, perhaps the greatest defect of all is the too early cutting of timber trees. Home-grown timber is often insufficiently matured when cut, and therefore builders and others prefer that from the Baltic and America, because it is more durable. It is seldom of sufficient girth and length to secure the highest price, and the grain, except when the trees have been carefully grown, is not straight enough for the more important uses.

Thinning out is often either entirely neglected, or, what is more common, often too severe and sudden. Growth on the one hand is weak for want of sufficient foliage to elaborate the sap, for only the upper branches of the trees exposed to the light and air bear leaves. There is an insufficiency of room for the proper development of root-fibre, the trees being too thick upon the ground. The best trees, too, are often taken instead of the worst, which is totally contrary to all rules of good forestry. When the thinning is too severe and sudden the result is premature decay, and death to many trees which have suddenly been exposed to winds and weather; storms are allowed to sweep through the wood and to loosen the root-hold; large gaps become frequent which bear no timber and therefore no revenue to the owner. Young trees which spring up in the gaps so formed are weak and too scattered to enable the forester to treat them as he would a regularly arranged thicket.

The natural pruning of conifers is not sufficiently attended to; this is most important, especially when dealing with larch plantations. It is only by a careful study of distance that this can be fully secured; because if too close canker and other diseases will be sure to manifest themselves; and if too far apart the lateral branches will not die off, but need artificial pruning. To develop a full complement of timber there must be sufficient foliage; this golden rule must not be forgotten. When artificial pruning is resorted to it is generally incorrectly performed, and when pruning is neglected evil results are not checked in time.

The signs of decay, so often manifest in old woods on trees apparently in full vigour, are not noticed as they might be, but decay is allowed to go on until the trees which have been intended for profit yield nothing at all. Young shoots and germens are destroyed in forest operations in a most careless way; and

in the management of underwoods the gradual conversion to high timber is usually entirely neglected. The forester, in fact, lives in the present, and not, as he should do, in the future. Foresight is required in forestry more than in any other branch of rural economy.

The differences of management required in large and small areas are not appreciated, and shelter belts are, as a rule, deplorably sad to look upon, simply because they have been treated upon the same principles as large areas. In our country the planting of shelter belts is more general than the planting of large areas, and therefore more attention should be given to the rules necessary to make them serve the double purpose of shelter and the development of commercial timber.

Planting for shelter, if wisely performed, adds greatly to the value of agricultural land, and in many cases the indirect benefit which results is sufficient to pay all the expenses attaching to the planting. This has been made clear in the evidence given before the Select Committee, and is a most important point in favour of an extension of our forest area. It is not too much to say that on exposed coast-lines, or bleak hill-sides, and valleys open to prevailing winds, wise and judicious planting will add 25 per cent. to the rental value of the surrounding land.

In the home nursery there is often most marked ignorance both in the preparation of the soil and in the manipulation of the young plants. To overcome this, many landowners buy their trees, or plant by contract, in doing which they largely increase the expenditure and add to the risks which naturally attach.

The late Mr. Frampton, of Moreton House, Dorchester—who planted during the sixty years he was in possession no less than 3,338,878 trees, and who might serve as an example to many landowners now living—said in his quaint, but practical and useful "Maxims for Moreton"—

> "'Tis waste of money, trees to buy;
> Raise them in your nursery."
>
> "Plant not young trees in beds too close together:
> They grow tall, weak, and will not stand the weather."
>
> "Transplant your Scotch fir seedlings every year;
> They'll grow more stout, and pay the labour clear."
>
> "Scotch firs and larch, at three years old best thrive;
> Oak, ash, at two or three, spruce four or five."

These couplets show a spirit of observation not often met with in landowners, and the result of his labours will speak for itself at Moreton.

Planting, the initial step to success or failure, is as a rule, on small estates, very carelessly conducted. Those employed

seem to forget that it is the most important step of all. Success does not rest alone in careful planting, however, but in the preparation of the ground, the choice of soil and site, the choice of such trees as suit the soil and the local demand, and the treatment during growth.

These, then, are some of the defects of our present system, and an inculcation of true forestry among those responsible for the inception and the manipulation would gradually but surely rectify them and bring about a new era in the growth of timber. Another and important result would undoubtedly be a large extension of planting; and lands now lying waste or unproductive, and further areas which are rapidly passing out of cultivation, notably the thin poor soils and the cold clays, might be made to yield a large supply of valuable timber at no distant period. Thereby landowners and the nation would be enriched, and depression such as now exists might in a measure be successfully combated. To a great extent, too, employment would be found for those who are, so to speak, indigenous to the soil, which would be more rational than providing funds for emigration and for the transplanting of our best bone and sinew.

To do this, however, necessitates the expenditure of capital, and this is of such vital importance as to need some careful consideration. The reduction of the interest on Consols will undoubtedly do much to stimulate the expenditure of capital on the land, and this alone may lead to an extension of planting.

The first question naturally will be, Will it pay? and the next, How can the money be obtained? That planting will pay if conducted on the lines of true forestry is in my opinion a foregone conclusion; and that it will not pay if these rules are ignored is equally certain.

The expenditure, even if the strictest economy is exercised, will be considerable, especially in the south of England, and therefore any one unwise enough to plunge into it without due and careful consideration, and without skilled advice, courts failure. To ensure success, soil not adapted to the growth of timber should not be planted, trees suitable to the soil should be chosen, and trees, moreover, for which there is a general or local demand.

These assertions, however, are insufficient to convince the practical mind, and figures must be resorted to. I approach these, however, with some reluctance, as, no matter how carefully they may be compiled, there is always room for doubt and question. This must be so in all hypothetical cases. Again, no series of figures will be complete without taking into consideration the accumulation of locked-up capital, and the yearly

expenditure of money not arising from direct revenue. In practice, however, the initial cost is, as it were, written off when expended, and the annual payments for local taxation, tithes, and interest on capital become merged with the general expenditure. Nevertheless, to arrive at actual cash results there is no alternative. I have therefore endeavoured to show in the following calculation that, even with a maximum expenditure and a minimum return, a fair profit will result.

It has been necessary in making such calculation to bear in mind that there are diversities of soils and situations, and the figures I have chosen may seem high to some and low to others. It is impossible in one example to meet all cases, and even if the examples were multiplied the same differences would exist.

For my purpose, I have taken 5*l.* 10*s.* as the cost of planting one acre of land with oaks or other hard-wood trees, nursed with Scotch and larch firs, which sum should include fencing. Fencing, of course, will be necessary in almost every instance, and the cost will vary with the size of the plantation—that is, the larger the area the less will be the cost per acre. The rent, rates, taxes, tithes, &c., I have taken at a low figure, because no one would plant land for commercial purposes capable of commanding a reasonable rent. Under these circumstances 9*s.* an acre seems a reasonable sum to take. The distance apart I have taken as 4 feet, because this is a useful distance, avoiding as it does the two extremes. The period taken is 40 years, a short period no doubt for the realisation of a crop of timber, but one sufficient to mature the firs planted as nurses. At the end of this period the land will be fully furnished with hard woods at the rate of nearly 200 to the acre. These I have not attempted to value, but they become, nevertheless, an important factor in the calculation. A further allowance of 200 trees, too, I have allowed for deaths and casualties. True, thinning out would probably take place at more frequent intervals, but for the purpose before us it does not seem necessary to go into minute detail. The object is to show that a fair return may be reasonably expected from wise and judicious planting.

Cost of planting one acre of land with mixed trees for commercial purposes, and the probable return in 40 *years.*

	£ s. d.	£ s. d.
Cost of trees (2,700), planting, fencing, and care during two years	5 10 0	
This sum will accumulate in 40 years at 5% to . .		38 10 0
Rent, rates, taxes, tithes, &c., say 9*s.* per annum .		
This annuity will accumulate in 40 years at 5% to .		54 0 0
		£92 10 0

Value of Produce.

	£ s. d.	£ s. d.
First thinning, 15 years after planting, say, 1,500 larch and Scotch fir, at 10*s.* per 100 (net) = . . .	7 10 0	
This sum will accumulate in 25 years at 5% to . .		52 10 0
Second thinning, 15 years later, say, 500 firs, at 5*l.* per 100 (net) = ...	25 0 0	
Which will accumulate in 10 years to		40 15 0
Third thinning, 10 years later, say, 300 firs at 15*l.* per 100 (net) = ...		45 0 0
		£138 5 0
Deduct expenditure as on page 358		92 10 0
Balance in favour of planting		£45 15 0

To this sum of 45*l.* 15*s.* must be added, as already stated, the value of the permanent hard-wood trees, which at 40 years of age, under the best method of management (which is of course implied), should be of considerable value. I have not taken into consideration any of the indirect benefits which invariably attach to planting operations.

These figures, then, I shall submit without further remark, and leave others to find in them what they are intended to convey. It is now necessary to pass on to the subject of the best methods of obtaining the necessary capital.

It might be supposed that money for this purpose might be obtained from the "Land Loan and Enfranchisement Company," or the "General Land Drainage and Improvement Company," incorporated by special Acts of Parliament. But the Land Commissioners for England who control these Acts have ruled, in regard to *planting*, that money can be advanced only for planting *for shelter* in connection with *agricultural* improvements.

The Settled Land Act, 1882, however, meets this difficulty to some extent by allowing capital trust money arising under the provisions of the Act to be expended in planting, and there seems no restriction as to what this planting should be for. This, nevertheless, is also subject to the control of the Land Commissioners, in so far that the enumeration of improvements contained in section 9 of the Improvement of Land Act, 1864, is extended so as to comprise all improvements authorised by this Act. Limited owners, therefore, have now a power which they did not before possess; but still it necessitates the raising of capital money.

It is worthy of consideration whether the powers of the existing land improvement companies might not be extended to include planting generally, and not for shelter or periodical cuttings only, subject of course to the controlling influence of the Land Commissioners. Further, if the period of 25 and 31 years

respectively could be considerably extended in cases of planting —which would tend to reduce the amount of the rentcharge— more landowners might be induced to take advantage of the means offered them.

There is, of course, always private capital which may be expended in planting, but in the case of limited owners there is little inducement to make such an investment, as such a step would be to increase the value of the freehold. The fall in the yield of Consols may tend to liberate capital for this purpose. I would here refer again to the tables of cost and return which I have given, and place the matter in a simple light. If, for instance, 5*l.* 10*s.* were invested at 5 per cent. and allowed to accumulate, and a yearly sum of 9*s.* also regularly invested at the same rate of interest, at the expiration of 40 years a sum of 92*l.* 10*s.* would result: this, too, without any labour or risk. On the other hand, if a similar sum of 5*l.* 10*s.* were expended in planting, 138*l.* 5*s.* would result, subject only to weather and other influences, which have, however, to some extent been allowed for. Surely this is worthy of consideration.

Again, to promote the expenditure of capital in planting land now lying waste, could not some relief be afforded to landowners in shape of a discontinuance of local and imperial taxation on such land for a period until actual return commenced? True, for this period the burden upon the remainder of the rateable property would be increased, but it would be so infinitesimal as to press heavily on no one. M. Boppe calculates that there are 5,000,000 acres of land in Scotland alone that might be profitably planted; then if that lying waste in Ireland and in England be added, there is a vast area ready for wise expenditure of capital. Much of this may be done by the State; and with the borrowing powers it now possesses surely something might be done.

Take Ireland, for instance, which has been almost disafforested: what an immense benefit would result from judicious planting! Much exposed land on the west coast, now waste and unfit for agricultural purposes, might by shelter be rendered fit for occupation, and thousands of men now out of work might be profitably employed. Look, too, at the employment which large areas of woodland would give to those living in and around the locality.

Much valuable information was elicited from the Rev. T. E. F. Flannery, P.P., Lord Powerscourt, and Mr. Gilchrist, in the evidence they gave before the Select Committee. This, coupled with the report of Mr. D. Howitz, Forest Conservator, laid before the Government in 1884 in the "Re-afforesting of

Waste Lands in Ireland; and the application of Forestry to the Remedy of the Destructive Torrents and Floods of the Catchment Basins of the Chief Rivers of Ireland," should suffice to bring about this desirable object.

The Government must, however, do this; private owners have neither the right to perform, nor the interest in such a widespread improvement. Their interests are centred in their demesnes, and planting, if conducted at all, will be confined to these areas. True, some more practical information will be needed before commencing such an important work; for, valuable as Mr. Howitz's report is, it lacks the essential element of practical finance. He places figures upon the probable produce of conifers which could not possibly be realised, and throws altogether too rosy a light on the undertaking. This does not imply, however, any doubt on a successful result. A large scheme of planting, too, would tend to relieve the congested districts of Ireland which are such a source of evil.

Some will say, no doubt, that to plant in such exposed sites would end in failure; but if the true principles of forestry are followed this will not be the case. What is required is to plant wide belts of conifers and other desirable trees simply for the purpose of shelter, and then to plant useful timber for commercial purposes inside these. Failure would not result if the areas planted were less small and restricted.

The evidence of the Rev. T. E. F. Flannery points to the fact that extensive planting could be carried out without injuring the rights of the people, and without depriving them of common and grazing rights; and he also expresses his belief that the people would themselves protect the areas so planted, knowing that the result would be for their own benefit.

It would be interesting to follow more closely the evidence of this witness, but it is already before those who really take an interest in the matter. It bears out most fully the belief that planting on a large scale on the west coast of Ireland would benefit the "distressful" country directly and indirectly.

Forestry, in the broad acceptation of the word, will not alone be advanced by a spread of the true principles among the masses; for assuredly, as the special education permeates the classes directly interested, so it will gradually reach the masses. It will in this way affect the London parks and open spaces, and extend and control the planting of streets and thoroughfares throughout the country.

Every one will admit that there is room for improvement in Kensington Gardens, Hyde Park, the Green Park, and other spaces of the kind, which are such a feature in the vast metro-

polis. Perhaps there is no area in the country which affords such pleasure, such invigorating influence, and such intense enjoyment to all sorts and conditions of men as the large combined area of the London parks. Though sylviculture is seen through a veil of smoke and soot, there is still something refreshing in the presence of tree life.

It is a source of regret to many to see how rapidly the fine old trees in many of the parks are dying, and it needs no stretch of imagination to depict a treeless area at no remote period, if vigorous steps are not taken to stay decay. Whether a more thorough and general knowledge of forestry would have prevented what it is now impossible to cure is an open question, and depends mainly upon the causes at work. There are several probable causes, or more probably it is a combination of causes, which have resulted in such widespread mischief. Much may be done to reinvigorate those trees which are dying, and much, too, may be done to prevent a similar result to the newly planted trees. If the Board of Works could be induced to excavate round some of the moribund trees and to dig into the subsoil, and by so doing ascertain the cause, much which is now obscure would be made plain; and having found the true reason of the decay a cure might be effected, or at least a similar result prevented. I have very little doubt myself what the causes really are, but this is not the place to give expression to them.

If a Board of Forestry existed this would probably form one of its functions. With regard to street planting, how little it is understood! Those who plant do not seem to realise the size to which the trees will eventually develop. As they are now planted the day is not far distant when they will form a nuisance of no mean magnitude. It is not an uncommon sight to see lime and other trees planted within six feet of a window, and on footpaths six feet wide.

However, we look with confidence to the Board of Forestry, and to the inculcation of a true knowledge of the principles of forestry, to rectify and control these matters.

How does the Select Committee on Forestry propose to deal with this question? At what conclusions have they arrived from the valuable evidence laid before them? Their report shows that their conclusions are practical, and the proposed remedy equally so. To a great extent they have accepted the scheme laid down in 1886 by Colonel Pearson and Mr. Rogers. Colonel Pearson says:—

"In order that all societies and public bodies interested in the good treatment of the land should have an interest in the system of education, I think that the general direction and control should rest with a Council or

Board, of which the Director of Kew Gardens might be *ex officio* president, and the forest professors at Cooper's Hill members, and to which the Royal Agricultural Society, the Highland Society, the Surveyors' Institution, and similar bodies should send delegates, while two or three of the great owners of private woodlands should be requested to sit on the board. This board would be necessary to keep the teaching in touch with the requirements of the country; and it should control the course of study, arrange for the examinations and granting of diplomas, and regulate the scale of fees."

The Select Committee in their report, say:—

"Your Committee recommend the establishment of a Forest Board. They are also satisfied by the evidence that the establishment of forest schools, or at any rate of a course of instruction and examination in forestry, would be desirable, and they think that the consideration of the best mode of carrying this into effect might be one of the functions entrusted to such a Forest Board.

"As regards the Board of Forestry, the Committee submit the following suggestions:—

"1. That the Board should be presided over by a responsible official (an expert by preference) appointed by the Government and reporting annually to some department of the Government.

"2. That the Board should be so constituted as to comprise the principal agencies interested in the promotion of a sounder knowledge of forestry, especially the various teaching and examining bodies, as well as the professional societies.

"3. That the following bodies should be invited to send delegates to the Board:—

The Royal Agricultural Society of England;
The Highland and Agricultural Society of Scotland;
The Royal Dublin Society;
The Office of Woods and Forests;
The Linnæan Society;
The Surveyors' Institution;
The English Arboricultural Society;
The Scottish Arboricultural Society;

and that the Director of Kew Gardens should be a member *ex officio*.

"4. That the Board should also comprise three members of each House of Parliament, and a certain number of owners or managers of large woodlands, a preference in the latter case being given to those who are in a position to afford facilities for study in their woods."

I have quoted the above *in extenso*, as it places the matter before us in a clear light; it will also be seen how fully the recommendation agrees with that suggested by the above-named witnesses.

Further, with regard to the functions of the Board:—

"(*a*) To organise forest schools, or, at any rate, a course of instruction in forestry.

"(*b*) To make provision for examinations.

"(*c*) To prepare an official syllabus and text-book."

That the examiner should be required to examine in the following subjects, namely:—

"(*a*) Practical forestry.
"(*b*) Botany.
"(*c*) Vegetable physiology and Entomology, especially in connection with diseases and insects affecting the growth of trees.
"(*d*) Geology, with special reference to soils.
"(*e*) Subjects connected with land-agency, such as land drainage, surveying, timber measuring, &c."

Here again the report agrees substantially with the suggestions already quoted.

It is difficult to conceive any better recommendations than those quoted, and if carried into effect the results that will ensue are such as will advance the wealth of landowners and the nation. The large areas now lying idle will be clothed with trees, and a system of culture will grow up similar to that in France and elsewhere. British forestry will no longer be open to the sinister comments of foreigners.

We have a climate better adapted than any other country in Europe to the growth of commercial timber, and yet our supply, especially in England, is both trifling in quantity and poor in quality. As has been pointed out, millions of acres might be planted if landowners and the State could be induced to do it. Another satisfactory result would be, as I have before stated, that, instead of advancing money from local taxes to encourage emigration, we should be able to give employment to our bone and sinew at home; and the villages now vacated, owing to the lapse of tillage, would again be full of life and activity.

The end and aim of the Board, if constituted, should be to impress this with all the power of their official position upon the landowners; because, if the inertia cannot be overcome, no Forest Board will be able to advance sylviculture in the least degree.

The Board, too, must be an active and not a passive body. It must possess life and energy in the highest degree, because, in addition to the duty of directing study, it will have to foster and encourage a love for an art which is foreign to the sympathies of those interested in our landed industries.

I have endeavoured in this article to lay before the reader the state of the woodlands of Great Britain and Ireland. I have condemned their management, and supported my opinion thereon by the evidence taken before the Select Committee. Then I have shown that this arises from a lack of the knowledge of the true principles of forestry, and this I have also supported by evidence. I have shown, too, what these principles are, and how the knowledge of them may be acquired; how the capital may be obtained for planting new areas, and how the existing areas may be improved by enlightened management; how the revenue may be increased and rendered regular by a systematic method

of management. Finally, I have supported the recommendation of the Select Committee, and shown how a well-constituted Board of Forestry, if active and enthusiastic, may encourage and stimulate private efforts to improve existing areas and to promote an extension of planting; how it may, by granting diplomas, encourage a really sound system of education, and attract young men of the right stamp to enter upon the course of study laid down; how, too, by publishing a text-book of forestry, the knowledge may be spread among the masses in an incipient manner. The work must be gradual, and no violent effort is needed. There must be a sufficient amount of enthusiasm in the Board to make itself felt among the landowning class; for, as I have already stated, if this is not done no study in the world will prevail against the inertia which has been prevalent during the last half-century. What is required is to bring about another sylvan period, like that already referred to as prevailing between the years 1750 and 1815, during which time the forest area largely increased.

Let me, in conclusion, recommend the owners of woodlands and the owners of land lying waste or unproductive, to turn their attention to the science of sylviculture. Let them obtain the advice of experts and organise a system which will result in improving the existing timber, in securing them a regular revenue, and in the judicious planting of new areas. Let them no longer be satisfied with the old rut, but leave it for a more enlightened way, and endeavour to act upon the cream of the evidence taken before the Select Committee, which must in future form the foundation of British forestry.

If I were asked to recommend a work on forestry I should unhesitatingly point to the three reports of 1885, 1886, and 1887, which contain the pent-up experience of half a century.

I cannot do better than conclude by quoting lines attributed to Sir Walter Scott:—

> "Be aye sticking in a tree, 'twill be
> Growin' whilst ye are sleepin'."

XX.—*Glimpses of Farming in the Channel Islands.* By William E. Bear, Riggindale Road, Streatham, Surrey.

Visits to the Channel Islands during the seed-time and harvest of the most important crops; a careful inspection of some of the best farms, fruit grounds, herds, and dairies; interviews with some of the highest resident authorities upon the several branches

of agriculture and fruit-growing; a persistent quest for information from all sorts and conditions of men met in my wanderings; and a careful study of official reports, books, and essays relating to my subject: these are the grounds upon which I venture to offer a few observations on the present condition of farming in those Isles of the Blest, which lie so close to France, and yet, happily, form part of the British Empire.

The present condition of any industry may be realised most clearly as a mental picture by comparison with the past condition of that industry; and, fortunately, I have no need to go beyond the volumes of the 'Journal' for an excellent account of the state of farming in the Channel Islands twenty-nine years ago. It was in 1859 that the prize essay written by Mr. (now Colonel) C. P. Le Cornu, a native of and resident in Jersey, appeared in this periodical (Vol. XX., Part I., First Series), and it will be interesting to note some of the most striking of the changes which have taken place since that period. As there are great differences in the systems of farming pursued in the several islands, it will be best to deal with each separately.

Jersey.

Although by far the largest of the islands, Jersey has an area of about 62 square miles only, the extreme length from east to west being 12 miles, and the greatest breadth about 7 miles. The total area is given in the Agricultural Returns as 28,717 acres, of which 20,561 acres were returned in 1887 as under crops, bare fallow, and grass. A foot-note, however, explains that some of the land is returned twice when two crops are grown on it in the same year; while, on the other hand, another note states that the acreage of woodlands is not ascertained. The corresponding cultivated area in 1859 is not given in the prize essay, but appears in the first complete collection of Agricultural Returns, in 1867, as 20,357 acres, or only about 200 acres less than in 1887. It cannot be supposed that the double return of acreage is made at all commonly, for, if it were, the cultivated area would come out much larger than it does; the growth of two crops in the same year on the arable land being the rule rather than the exception. According to a return of the acreage occupied by owners and tenants respectively, there were 19,626 acres of occupied land in 1887.

From causes which I have not seen explained, the population of Jersey has diminished since 1851, when it was 57,020: the number returned at the census of 1881 having been 52,445. Between 1871 and 1881 there appears to have been a decrease

of population in all but two of the twelve parishes into which the island is divided. If this decrease stood alone, it might, perhaps, be accounted for by the fact that the population was temporarily swollen by French refugees during the Franco-German War; but as there was a fall between 1851 and 1861, and, in spite of a rise in 1871, a further fall between 1861 and 1881, this explanation is not sufficient. The point is of immediate interest in connection with my subject, because the decrease in population during a period of great prosperity in Jersey seems to show that the tendency to the subdivision of landed property fostered by law, which forbids the willing of land and requires its division among all the children of a deceased owner, has been counteracted by sensible family arrangements.

Whether the land is more or less subdivided than it was when Colonel Le Cornu wrote his prize essay, I am not able positively to determine; but, probably, it may be concluded from the evidence just cited that there is not much difference. At any rate, the average size of a holding is small enough; for, according to the Official Return of 1887, the 19,626 acres of occupied land were divided among 2,646 occupiers, partly owners and partly tenants, or in the ratio of almost exactly $7\frac{1}{2}$ acres per occupier. In 1859, Colonel Le Cornu wrote:—

"Very many houses will be found to which only 2 or 3 acres are attached, whilst others have 20 or 30; but an estate which contains 15 acres is by no means considered a small one, and rarely do any exceed 50 to 60 acres; there may, perhaps, be six or eight such in the whole island."

This statement, I believe, holds good for the present time, except that I could not hear of as many as six or eight farms of 50 acres and upwards. A farm of 50 *vergées* ($2\frac{1}{4}$ to the acre), or about 22 acres, is reckoned a large one; and the owner of 106 *vergées* (47 acres), which he cultivated till he let half of the land, informed me that he knew of only one larger farm in his part of the island.

The law as to the succession to landed property is as follows:—The eldest son takes as his birthright the house and premises, with a little more than two acres of land adjoining, and about twenty Jersey perches, or two-ninths of an imperial acre, for every man he is bound by ancient law to provide in case of war. The rest of the property is valued in rents, and the eldest son takes one-tenth, the remainder being shared, two-thirds among the sons, including the eldest, and one-third among the daughters. When there is only one son he takes all that is above referred to as going to the eldest and other sons. When the number of daughters is so small that each, if more

than one, would get more property than each of the sons, the latter can insist upon equal division. Even during life, a father cannot give to any child more land than would come to him or her under the law of inheritance, and any gift of the kind, if excessive, can be annulled within one year of the father's death.

The law of mortgage is so curious that it may be briefly mentioned. In the event of an estate being over-mortgaged, the last mortgagee can only recover his money by taking up the estate and engaging to pay off all the burdens upon it. Should he refuse, he loses all claim to the sum he has advanced; and the estate is offered to the next mortgagee on the same terms, and so on till it finds a proprietor. As all mortgages are registered, it is contended that there is no hardship in this law, because each successive mortgagee knows what burdens there are upon the estate, and if he risks his money in increasing them, he does so with his eyes open, and it is only just that he should not be able by his folly to diminish the security of earlier mortgagees. Not so defensible is the law which makes all parts of the property of a landowner jointly and severally liable for his debts of any kind, even including portions leased or sold: so that the creditors can come upon the property of the leaseholder or the buyer if necessary in order to recover their dues.

The most common method of paying for land purchased greatly facilitates its acquisition by men of small capital. The purchaser usually pays at least one-fourth of the price of the land, and the rest can be paid in what are termed quarters of rent, equivalent to a mortgage, but saleable in the open market at a fixed rate of interest, a fraction over 4 per cent. There are old rents (*rentes*, more like stocks than what are commonly understood by rents in England) of 18*l.* a quarter, and new rents of 20*l.* a quarter. Formerly the old rents were non-transferable, and worth 16*l.* a quarter; but some time ago they were made transferable at 18*l.* The security for old rents is on all the real property of the borrower; whereas on new rents it is on only the particular piece of property mortgaged. So long as the purchaser of the land pays the interest on the quarters he cannot be dispossessed, and he can at any time partly or wholly redeem his property from the burden upon it by buying up some or the whole of the rents. This he can do when and to any extent that may suit his convenience; while the money can never be called in, as it can be in the case of a mortgage.

Before referring to the prices at which land in Jersey is sold and let, it may perhaps be desirable to say a few words about the character of the soil and the climate. In a considerable work on the Channel Islands, published in 1862 by W. H. Allen &

Co., of London, the authors (D. T. Ansted, M.A., F.R.S., and Robert Gordon, M.D., F.R.S.), after describing at great length the geological formations of the islands, say:—

"In all the underlying rocks of the various islands there would seem to be a total absence of phosphorus, without which the cultivation of food-plants is impossible. Potash, also, is either present in small proportion, or in a form not readily separated. There does not seem to be any organic matter present, except that derived from animal life now or recently at the surface. However rapidly, therefore, the soils obtained from these rocks become decomposed, and however well the resulting soils may look, there is clearly no natural and large supply of certain ingredients essential for food crops. All these must be supplied from without in the form of manure, either animal, vegetable, or mineral.

"The latter [query the last?] not being available, it results that without a large and constant supply of animal and vegetable manures, the soil of the islands could not be kept in such a state as to yield large crops of the most valuable kinds of vegetable produce. It is clear, therefore, that, in spite of all statements that have been made to the contrary, the soil in the islands cannot properly be regarded as naturally rich" (p. 465).

The writers support these statements by elaborate details as to the constituents of the rocks from which the soils of the islands have been formed. On the other hand, the writer of the prize essay says that, "although situated on a rocky bed, the soil of Jersey is particularly rich and highly productive." This might be the case, and yet not in conflict with the statements above quoted, for soils not naturally productive may be made so by man. Colonel Le Cornu, however, says:—

"The rock is of the primary formation, void of any organic remains, chiefly granite, syenite, gneiss, porphyry, and schist, with other varieties belonging to this series. It might be supposed that the fact of the soil reposing on so rocky a bottom might produce meagreness, but it is not the case. The soil is a rich loam, varying in lightness according to the stratum beneath it; if granite or syenite, it is lighter than where the other varieties of rock are found. The cause to which this difference is attributable is, that immediately between the granite and cultivated soil is a layer of coarse gravel, which acts as constant drainage, whereas when the granite and syenite disappear no gravel is found, but a light clay forms the layer between the soil and the rock. As a general rule, the eastern district of the island may be said to belong to the latter formation, and the western to the former, but in both cases there are exceptions. For certain kinds of produce the one is more esteemed than the other, but the universal opinion throughout the island is that the eastern district is the richest and most productive."

In the Report of the Royal Jersey Agricultural and Horticultural Society for 1887 analyses are given of three specimens of Jersey soil, made by Mr. F. Woodland Toms, the States (of Jersey) analyst, and M. Laurot, analyst of the Laboratory of Granville. One sample was from a drilling-ground in the south-west, another from a similar ground in the north-west (both described as "virgin soils"), and the third from heavy pasture land in the eastern district. The samples were taken as repre-

senting the light, medium, and heavy soils of the island. A square block, one foot in depth, was used in each case, and it was found that the subsoil for the next ten feet in depth was in each instance of similar texture to the surface soil, which was very free from stones. The analyses are given below :—

COMPOSITIONS OF DRY SOILS PER CENT.

FIRST 12 INCHES.

	St. Peter's	St. Mary's	St. Saviour's
Soluble in weak acids.	No. I.	No. II.	No. III.
[1] Organic matter, &c.	3·590	3·760	3·980
Oxide of iron	·610	1·724	2·245
Alumina	·372	1·497	1·403
Lime	·236	·187	·576
Magnesia	·148	·291	·200
Potash	·086	·114	·158
Soda	·328	·355	·537
Phosphoric acid	·128	·131	·195
Sulphuric acid	·182	·236	·184
Chlorine	·009	·011	·009
Carbonic acid	trace	trace	trace
Soluble silica	·079	·080	·084
Insoluble in acids.			
Hydrated silica	2·500	2·780	6·100
Insoluble silicates and quartz	91·732	88·834	84·329
	100·000	100·000	100·000
[1] Nitrogen in organic matter	·122	·136	·141
Nitrogen as nitrates (per million parts)	2·108	1·650	6·45

These analyses do not convey the idea of any high degree of natural fertility, though No. III. is much superior to the two others, and No. II. is rather better than No. I. All three are deficient in lime and potash, and in only one is there a good proportion of phosphoric acid. As to the organic matter, soldiers' drilling-grounds can scarcely be quite like "virgin soils," and the old pasture certainly is not so. They are all soils, however, which can be worked with more or less facility; while two of them are so constituted as to retain moisture fairly, and one so as to retain fertilising material applied to it.

The "lay of the land" in Jersey is all that could be desired, as it is a gradual slope downwards from the north to the south, and this greatly enhances the value of the soil, and promotes the early vegetation for which the island is famous.

Of the climate there is no necessity to say much, as it is well known to be excellent. There is seldom much snow, and

often none at all during the winter, and severe frost is uncommon. During last winter and spring there was more snow, and greater damage occurred from frost, than had been known for several years. The rainfall is abundant, especially in winter, and the island seldom suffers from drought even in summer.

Whatever the natural resources of the soil of Jersey may be, it is certain that it has been brought to a state of high fertility. I have never so fully realised the idea of a country "smiling" with an abundant produce, and with a general air of prosperity, as when, in the latter part of June, I walked or drove through the beautiful valleys and over the scarcely less charming plains of Jersey. Bad as the season had been, the comparatively few pieces of wheat were in ear, and almost without exception good standing crops, where not absolutely heavy; while the potato tops were a yard high, and so thick that the rows could not be distinguished. Splendid crops of hay and "seeds" were being cut or carried, and the tethered cows looked sleek and well fed.

But not even the abundance of the produce of the soil, or the evidence of careful enterprise bestowed on every spot, strikes the visitor familiar with the rural districts of England so forcibly as the wonderfully prosperous aspect of the dwellings of the people. There are scarcely any cottages in Jersey, for the smallest of the farmers, as a rule, live in comfortable granite houses, with well-kept flower and vegetable gardens attached to them. The people themselves, too, have an air of contentment and independence which is pleasing to behold.

The climate, no doubt, does great things for Jersey; but the marvellous industry and enterprise of the people do more. The rents which those of them who hire land pay, and the prices which buyers give for land, suffice to assure even persons who have not visited the island that a vast quantity of produce is got out of the soil. When Colonel Le Cornu wrote his essay, he gave 4*l.* 10*s.* to 9*l.* as the range of rents. The present range for cultivable land may be put at 7*l.* to 15*l.* It must be very poor land that does not let at more than 3*l.* a *vergée*, or 6*l.* 15*s.* an acre. The only farm which I saw that I had reason to suppose was let at less than 7*l.* an acre was one containing a large proportion of woodland; but there are, no doubt, a few others equally poor and low-rented—as rents go in Jersey. As to the prices given for the fee-simple, some actual instances of recent sales may be cited.

Mr. Joshua Le Gros, Secretary of the Jersey Herd-Book Society, a Jersey farmer of great experience, to whom I am indebted for a great deal of valuable information, and for the courtesy with which he accompanied me in some excursions and

directed me in others, sold a farm of about twenty-three acres this year at 263*l.* an acre. He has since bought a small farm of six acres, with a good house and premises upon it, at 180*l.* a *vergée* ($2\frac{1}{4}$ *vergées* to the acre), or 405*l.* an acre. In this case the residence counts for a good deal; but Mr. Le Gros estimated that the land alone would have realised 140*l.* a *vergée*, or 315*l.* an acre. The farm is about a mile and a half from St. Heliers, and it contains a little terraced land well suited for the growth of early potatoes.

To take another instance. Mr. Philip Lefeuvre, of St. Owens, informed me that he had recently bought $4\frac{1}{2}$ *vergées* of land for 500*l.*, or at the rate of about 250*l.* an acre. This is in the west of the island, where the soil is less rich than it is in the east or in the vicinity of St. Heliers. The price, however, was considered exceptionally high for the district. Again, Mr. Gaunt, of St. Saviour's, in the east of the island, told me of a farm of 39 *vergées* sold the other day in his district for 3,550*l.*, or at about 206*l.* an acre. For his own estate of 106 *vergées*, bought many years ago, he paid 80*l.* a *vergée*, or 180*l.* an acre; and he assured me that he could since have made a profit of 2,000*l.* if he had been disposed to get rid of his land. He has recently let half of his land at 10*l.* 12*s.* 6*d.* an acre, but could have had over 11*l.* if he had chosen to invite competition. Such an extreme rent as 15*l.*, I may explain, is obtained for very favourably situated spots not far from St. Heliers, and for small pieces of very good ground; slopes of land facing the south or south-east, known as *côtils*,[1] upon which potatoes can be produced very early, are the most valuable spots in the island when the soil is good.

It will be noticed that interest at a little over 4 per cent., on even such high prices for the fee-simple of land as are given above, would not come to as much as the highest of the rents on land let to tenants. Perhaps this can partly be explained by the existence of burdens upon owners that tenants escape; but apart from that consideration, there is, no doubt, a much greater competition for the hiring of land than for its purchase. There would be nothing surprising in such a state of things under ordinary circumstances; but in Jersey there are special circumstances to be considered. Numbers of French

[1] As to this word "*côtil*," which one constantly hears in Jersey, I have in vain endeavoured to trace its derivation. *Coteau* is the only modern French word that corresponds with the Jersey *côtil* in meaning—the slope of a hill. *Cote* (hill) is, no doubt, the root-word. Colonel Le Cornu informs me that it is doubtless an old Norman word, the literal meaning of which is hill-side ground. It is found in old deeds of conveyance.

labourers, who come to the island for the potato-harvest and save money, are anxious competitors for small farms, and will pay almost any rent for them. They may or may not be in a position to pay the small sum needed as a deposit on purchasing land; but there is a more serious difficulty in the way, for no foreigner can become possessed of land in Jersey until he has been naturalised as a British subject, and naturalisation is allowed only after several years' residence, and very charily even then. The authorities are not pleased at seeing the land more and more occupied by Frenchmen, and they are not at all disposed to facilitate the acquisition of rights of purchase by the foreigners.

Every one must regret to see the fine race of Jersey farmers —men whose ancestors have held land in the island since long before the Norman Conquest—diminishing in number as they are. There is no doubt that rents have been forced up to an extravagant extent by the eager competition of Brittany peasants who have been trained in the art of living on next to nothing, and who can therefore maintain themselves and their families upon meagre profits which would not content Jerseymen. Under such circumstances, young Jerseymen who inherit land are tempted to let it, and to supplement the income which they thus obtain by engaging in commercial or other pursuits. Many of them shrink from the unremitting and arduous labour in which their parents have spent their lives, and which they have shared during their boyhood.

It may be suggested that those of them who own moderately large farms, or what are deemed such in Jersey, might farm the land without working constantly upon it; but the universal testimony in the island is that this would not do, as it is only by working with the few men he employs that the Jersey farmer can thrive. Many English farmers have bought or hired land in the island, and attempted to farm it after the English easy-going fashion; but not one has succeeded. The only Englishman who has been successful as a farmer in Jersey, I was assured, is Mr. John Gaunt, of St. Saviour's, who came to the island for his health many years ago, after having been successfully engaged in commerce in England. But Mr. Gaunt has succeeded by doing as the Jersey farmers do. On the occasion of my last visit to him he had been to St. Heliers, nearly four miles distant, with one cartload of potatoes to be shipped, and was getting ready for a second journey. He is over seventy, and a rich man without family; yet he declares that when he gives up work he will give up farming.

It must not be supposed, however, that there is anything

suggestive of penury in the style of living which the larger Jersey farmers adopt. On the contrary, the houses and appointments, interior and exterior, of many a Jersey farmer holding (and generally owning) twenty acres of land, strike the visitor as superior to those of most English farmers of two hundred acres. After finding the Jersey farmer at work in the field with his men, it is somewhat surprising to a stranger to be conducted by him into a drawing-room fitted up with all the modern decorations found in a middle-class suburban residence. There is not much "tally-ho" for the Jersey farmers, I believe; but the plough does not keep them from getting a fair education, while their wives and daughters happily distribute their attentions between the cow and the piano.

It is the great returns obtained from the production of early potatoes which have forced up rents to extravagant rates. In all probability there will have to be a considerable fall before long, for early potatoes have this year been coming more abundantly than heretofore from other sources than the Channel Islands, and prices have been very low in two out of the last three years. There was, I believe, a downward tendency in rents and land values two years ago; but it was apparently stopped by the large returns obtained from the potato crop last year.

Nothing more strikingly indicates change in the system of farming in Jersey than this sentence in the prize essay of 1859: "Jersey was once famous for the cultivation of potatoes." The writer proceeds to point out that, before the visitation of the potato disease, the production of 18 tons of tubers per acre was not uncommon, whereas it was a good crop in 1859 to yield 8 or 9 tons per acre. It is to be borne in mind that "old" or fully matured potatoes are here referred to, the practice of growing new potatoes for export not having begun. The general course of cropping in 1859, the same writer states, was one of five years, as follows:—(1) turnips, mangolds, parsnips; (2) potatoes, and frequently carrots or parsnips; (3) wheat, in which clover and ryegrass are sown; (4) hay; (5) hay. In this division, potatoes occupied only about one-tenth of the land, and farms of 20 acres, with few exceptions, where meadow-lands or orchards predominate, are said to have been thus divided:—Hay and pasture, 10 acres; turnips, 2; mangolds, 1; parsnips, 1; carrots, $\frac{3}{4}$; potatoes, 2; wheat, $3\frac{1}{4}$. Even among the old-fashioned farmers, the course is greatly changed now, being one of potatoes for two years, corn for one year, and clover or mixed seeds for one year or two years. More commonly, however, the farmers grow potatoes for two or three years, and then rest the land by

sowing clover and ryegrass after the potatoes are dug, and letting the crop stand for two or three years. In this case a good deal of feed is commonly obtained in the autumn, the seeds being sown in July. Very little corn is grown, as will be seen from the table appended, and most of the barley is planted after potatoes come off the land, to be harvested the same year. It is not surprising, then, to find that potatoes occupy about one-third of the total area under crops, fallow, and grass in Jersey, instead of less than one-tenth, as estimated by the writer above referred to in 1859—less than one-tenth, because he excepted grass and fruit farms from his estimate.

Unfortunately there are no precise crop statistics for an earlier year than 1867 (unless the doubtful figures for 1866 be taken), and we must be contented with seeing the differences which twenty years have brought about, as below:—

Crops in Jersey	1867	1887
	Acres	Acres
Wheat	2,352	1,876
Barley	137	119
Oats	303	163
Rye	21	52
Beans	12	6
Peas	2	20
Total Corn Crops	2,827	2,236
Potatoes	2,062	6,488
Turnips	1,547	1,705
Mangolds	730	724
Carrots	913	113
Cabbage, rape, &c.	159	50
Vetches, lucerne, &c.	225	583
Total Green Crops	5,636	9,663
Clover, &c., and grasses under rotation	3,250	4,832
Permanent pasture	6,092	3,701
Hops	—	3
Bare fallow	2,550	126
Crops, bare fallow and grass	20,355	20,561

Here we have a decrease of nearly six hundred acres of corn crops, an increase of 4,426 acres under potatoes, a great falling off in the cultivation of carrots, a great increase under vetches, lucerne, &c., and clover and grasses under rotation, a decrease of permanent pasture by over 2,300 acres, and an approach to the extinction of bare fallow.

Experienced farmers in Jersey say that many of the small holders of land devote too much of it to the potato crop, and frequently lose by so doing. For instance, they have to pay considerable amounts for hay and straw imported from France for their cattle. Many of them grow potatoes year after year for several years on the same land, which is only saved from deterioration by a heavy expenditure in manures. A second crop is always taken after potatoes, consisting of roots of some kind, or "seeds" when the land is to have a rest for a year or two, or occasionally barley. Probably when hay and straw are cheap, and potatoes sell fairly, the profits on the latter crop more than make up for the expenditure on imported fodder; but last year high prices had to be paid for both hay and straw.

The details as to the cost of growing a *vergée* of potatoes were supplied to me by Mr. Joshua Le Gros, and I add below the corresponding amounts per acre:—

Cost of Growing Potatoes in Jersey	Per vergée			Per acre		
	£	s.	d.	£	s.	d.
Rent	4	0	0	9	0	0
Seed	4	0	0	9	0	0
Scotch manure	4	0	0	9	0	0
Guano or artificial	4	0	0	9	0	0
Planting	1	0	0	2	5	0
Digging	1	5	0	2	16	3
Carting	0	12	0	1	7	0
Ploughing, hoeing, picking up, &c.	1	3	0	2	11	9
	20	0	0	45	0	0

It is considered that at least 50*l.* an acre must be received from the sale of potatoes in order to pay the Jersey farmer, and it is clear that, on his small acreage, he needs more than that, although his second crop, grown at a very small expense, must not be lost sight of. When a man and his family do all the work, the expense of raising the potato crop is, of course, greatly reduced, especially when seaweed—*vraic*, as it is termed—is chiefly relied on as manure. It is not deemed the best practice to apply seaweed directly to the potato crop, though it is often done. The better plan is to put it on for the temporary pasture or "seeds," after which the potatoes are grown.

Seaweed is highly prized by the people of Jersey as a manure, and no doubt it contains some of the constituents in which their soil is deficient, including the potash so essential to the potato crop. The cost of the labour in obtaining it, however, is so great that it is a question whether what it supplies to the land could not be more cheaply obtained. In March last

I frequently met twenty or thirty carts loaded with *vraic* coming up a road from the seashore. It costs practically nothing besides the labour of getting it—only a nominal fee of a shilling a year being charged for the right of cutting it from the rocks on some parts of the coast, and, I believe, not even that in others. Moreover, a great deal, of course, depends upon whether a farmer and his sons do all the work or have to employ others to assist in collecting the seaweed. At any rate, the ardour for collecting it is still considerable; one wealthy farmer, by way of illustrating the fact, having assured me that his son had been out all night at the work, and this more than once during the week. Women used to help in the gathering, but seldom do so now. Sometimes the seaweed is burnt, and the ashes are applied as a dressing for the potato crop. In that case I think it may be taken for granted that the ashes cost a great deal more per cwt. than equally valuable artificial manure would cost.

Before referring to the returns of the potato crop, a few remarks upon its cultivation are desirable. To begin with, nothing is more important in the system pursued in Jersey than the careful preservation and preparation of the seed tubers. In the first place, a frequent change of seed is regarded as essential, and seed tubers of the Ashleaf and other varieties are imported from England regularly. In the first year after importation the crop is abundant, but rather later than that grown from Jersey seed. In the second year the stock is in its perfection, earliness and yield being both satisfactory. After that the vigour of the stock deteriorates, as shown in declining yield; and it is desirable to have a fresh lot of English seed after the third year.

Whether home-grown or imported, the seed consists of whole sets, as a rule, rather small tubers being alone saved for seed. These are placed, eyes upwards, in shallow boxes of thin deal, where they remain till taken out into the field to be planted. The boxes are piled up one upon another in a shed or barn, and the seed is taken in them to the field without having been disturbed. The tubers have by that time sent out strong green shoots, about an inch in length, which are carefully kept uppermost in planting. In this way the produce is brought to such a degree of maturity as it is allowed to reach, a month earlier than it would be if potatoes without shoots were planted. The system of cultivating the land for potatoes is well described by Colonel Le Cornu in his prize essay on "The Potato in Jersey," in the sixth volume of the present series of the 'Journal' (1870). In ploughing, a small plough drawn by two horses is used, turning a 16-inch furrow, about 4 inches deep. This is followed

by the great Jersey plough, drawn by six horses, which goes about 10 inches (deeper in 1869) below the depth touched by the small plough. Formerly the stable manure or seaweed was put on the land before the ploughing was begun; but now it is usual to put it on just before sowing the seed, except, as already explained, when seaweed is put on the temporary grasses of the preceding year.

Planting is, in favourable seasons, begun in January, and should be finished by the end of February; but this year the work was not nearly finished by the middle of March. The seed is planted in rows 14 inches to 20 inches apart, the sets being about 12 inches apart in the rows. The work is usually done with a small one-horse plough, the sets being covered with only 2 or 3 inches of soil. From 30 to 40 *cabots* per *vergée*, or 17 to 26 cwt. per acre, according to the size of the sets, are commonly planted now, according to Mr. Le Gros. Colonel Le Cornu, in 1870, said about 20 *cabots* per *vergée* used to be planted; but this was probably when "old" potatoes were produced. The land is usually lightly harrowed just before the tops prick through, then forked up between the rows and hoed in the rows when the tops show, and afterwards the tops are earthed up with the plough. The crop is usually dug up by hand, and not often ploughed up. The price paid for digging and collecting the tubers in rows is about 25*s.* a *vergée* when labourers are hired to do the work; but this does not include picking up or filling the carts.

The varieties of potatoes most commonly grown in 1870, according to Colonel Le Cornu, were the Ashleaf, Prolific, Early Fluke, Trois Mois, Dalmahoy, and Early Regents. At present the prevailing sorts are the Ashleaf (Myatt's), the Royal Jersey Fluke, the Old Jersey Fluke, and Prince of Wales. The old Jersey Fluke is considered the best of all varieties, or at least as good as Myatt's Ashleaf; but the favourite variety among growers now is the Royal Jersey Fluke, although it is of inferior quality. The reason of the preference for the last-named variety is that it is very early and prolific, while the tubers are large. London buyers, it appears, will have large tubers, no matter what the quality may be. At any rate, although the quality of the Royal Jersey Fluke is notoriously poor, it was selling at 1*s.* a *cabot*, or 52*s.* a ton, more than the Ashleaf at the end of June. Such an argument for the growth of the variety is irresistible; but there are some misgivings lest Jersey potatoes should lose their reputation among British consumers, although dealers appear to care more for appearance than for flavour.

In an early season, digging commences on the most forward

of the *côtils* in the last week of April or (more commonly) the beginning of May, but was more than a month later than usual this year. Indeed, very few potatoes had been dug when I was in Jersey, in the third week of June. These remarks refer, of course, to the outdoor crop, forced potatoes being ready as early as January, and those grown in cool-houses in the latter part of April; but the production of the crop under glass is not common in Jersey, though it is in Guernsey, as will hereafter appear. Although the yield of the potatoes first taken up—often before the skins are properly set—is, of course, smaller than when they are left to mature a few weeks longer, a week makes such an enormous difference in the price that there is a race to meet the early demand. In the season of 1887, which was not an early one, the small lots of tubers shipped in the week ending May 28, according to the weekly returns collected by Mr. Barbier of St. Heliers, sold at the rate of 22*l*. 10*s*. a ton, while for the week ending June 16 the price was only 5*l*. 12*s*. 7*d*. This year the first lots realised 10*s*. per *cabot*, or 26*l*. a ton; but in the third week of shipping the price had fallen to 1*s*. 8*d*. per *cabot* for Ashleaf and 2*s*. 8*d*. for Royal Jersey Flukes, or 4*l*. 7*s*. to not quite 6*l*. a ton. This tremendous drop was owing to the extreme lateness of the crop in Jersey, the London market being speedily glutted with produce from other sources.

With respect to yield, Quayle, who wrote in 1812, vouches for 12 to 14 *cabots* per Jersey perch ("old" potatoes), or 23½ to 24 tons per acre, being often obtained, and speaks of a quantity equivalent to 26 tons per acre having been grown; but some exaggeration may be suspected in these statements, though a phenomenal crop of 24 tons per acre, mentioned with the grower's name, may have been produced once in a while before the disease was known. A yield of 10½ tons per acre is considered a good crop now that only early potatoes are produced; while 12 to 14 tons, occasionally grown, would be regarded as a great crop; and 17 tons, talked of as having been produced, would be reckoned a tremendous yield. Such yields are not obtained upon the earliest diggings. Mr. John Gaunt, however, informed me that he grew 6 *cabots* per Jersey perch, or 9 tons 13 cwts. per acre all round, last year, and sold the produce at 1*s*. 9*d*. to 4*s*. 6*d*. per *cabot*. As the yield of the potatoes that sold at the highest price was probably less than the average, it is not warrantable to translate these figures into 47*l*. 5*s*. to 121*l*. 10*s*. per acre; but Mr. Gaunt's average return was 90*l*. an acre on 60 perches of *côtils* for the three years ending with 1887. Another account, given me by Mr. Philip Lefeuvre, of St. Owens, where the land is not as rich as it is in Mr. Gaunt's district, was to

the effect that his average returns for 13 *vergées* of potato-land for the four years ending with 1887 was 27*l.* per *vergée*, or 60*l.* 15*s.* per acre. This season Mr. Lefeuvre was one of the first to dig out-door potatoes, and he realised 8*s.* per *cabot* in the first week of June, or 20*l.* 16*s.* per ton. Probably the yield of the crop was not large, as the tubers could scarcely have attained much size; but if it were only 3 *cabots* per perch, the gross returns were 108*l.* an acre.

More astonishing than any of these figures are those given in the *British Press and Jersey Times Almanack*, as from "reliable, though unofficial sources," making the exports of potatoes from Jersey last year amount to 50,670 tons, valued at 434,917*l.* As there were 6,488 acres of potatoes in the island in 1887, this account makes the average gross returns equal to over 67*l.* an acre, without allowing anything for potatoes consumed at home and saved for seed. Judging from the official Annual Statement of Trade for the United Kingdom, and the value of the exports from Guernsey, declared by the Guernsey Chamber of Commerce, the figures given above are under-estimates; for the value of potatoes imported from the Channel Islands is put down in the "Statement" at 511,278*l.*, while the exports of tubers from Guernsey are valued by the Chamber at 50,000*l.* The balance, 461,278*l.*, would allow over 71*l.* for every acre in Jersey. In addition to the quantity exported, it is estimated that 8,000 tons were retained in the island.[1] It is true that 1887 was an exceptionally good year for Jersey growers. In 1886, which was a very bad year in respect of prices, the exports were estimated at 62,208 tons, valued at 279,572*l.* This valuation makes the return for exported tubers under 44*l.* per acre on the 6,411 acres grown in that year; but there is a great discrepancy between the official and unofficial values for 1886. In the "Annual Statement," the value of potatoes imported in that year from the Channel Islands (and there are no direct imports from Alderney or Sark) is put at 459,395*l.* Therefore, unless the value of the potatoes exported from Guernsey in 1886 was very much greater than that of 1887, which is unlikely, the value of the Jersey exports must have been over 100,000*l.* in excess of the sum stated in the unofficial estimate.

It is to be feared that the returns on the potato crop this year will be lower than they have been in any previous year since early tubers were grown in the island. It has been stated

[1] The French Consul at St. Heliers, in a Report sent to his own Government, valued the potato crop of 1887 at 72*l.* for every acre grown in Jersey.

that the price fell quickly to from 1*s.* 8*d.* to 2*s.* 8*d.* a *cabot*, and the range of values did not long continue as high as that. Writing on July 28, Mr. Le Gros says:—

> "As regards the potato crop, it has been almost a failure. Although there has been a heavy crop, the price has been so low that the loss to farmers is enormous. During this week it has come down to 6*d.* a *cabot*, and many farmers have realised only from 9*l.* to 10*l.* a *vergée*, barely enough to pay the rent and labour."

Sixpence a *cabot* is 26*s.* a ton—certainly a ruinous price. As the expenses of freight and commission exceed this amount, it is to be presumed that Mr. Le Gros has allowed for them, and that 6*d.* per *cabot* is the net price received by growers. Even so it is ruinous in many instances, as it means a loss of over 20*l.* an acre where the cost of growing was nearly or quite 45*l.*, and the receipts 10*l.* a *vergée*, or 22*l.* 10*s.* an acre.

In the prize essay already referred to, there is a table giving the exports of potatoes from Jersey in nearly every year from 1807—when the business commenced, and 600 tons were shipped —to 1867. The largest quantity was that for 1842—18,560 tons. These were chiefly, if not entirely, fully-matured or "old" potatoes. In 1845 the disease first affected the crop in the island, and then the exports fell to 3,822 tons. By 1867 they had risen to 6,251—still, to a great extent, "old" potatoes. The figures given above for 1886 and 1887 show what a wonderful increase has taken place, especially when it is borne in mind that the exports consist entirely of early tubers, the shipping being finished by the end of August.

Great numbers of Brittany peasants, with their wives and some children, migrate to Jersey for the potato harvest. The number is supposed to be from two to three thousand. This year, unfortunately, these poor people came over too soon, the crop being very late, and when I was there at the end of June there were great numbers of them in St. Heliers with nothing to do. Their case was a sad one, as they came over with scarcely any money, and they could not afford to pay for lodgings. Since in the previous year they had herded so thickly in the cheap lodgings of the town as to leave a great deal of disease behind them, the authorities had fitted up the cattle market, to the extent of putting straw in the sheds and pieces of sailcloth in front, for their reception. Over six hundred of them, men, women, and children, slept in these comfortless lodgings at the time referred to. As a rule, when they have work in the country, they sleep under hedges, when the weather is fine, or in sheds, or under stacks—anywhere to escape the expense of proper lodgings. They earn very good wages, 25*s.* a *vergée* being

the usual price for digging potatoes, though this season many of them got only 20*s.* to 24*s.* A man often earns 5*s.* a day at this work. When employed by the day, the men get 2*s.* 6*d.* with food and cider, or 3*s.* 6*d.* without food. Women have 1*s.* to 1*s.* 3*d.*, with food and cider. Two men digging will keep three women employed, one gathering tops, and two picking up the tubers and laying them in rows. Ordinary wages appear to be about 12*s.* a week and cider in the winter, and 15*s.*, with cider, in summer.

The system of storing hay in the island is peculiar. It is generally tied in bundles and stored in granaries or barns, though some is stacked. The scarcity of straw and the expense of thatching render the farmers anxious to avoid stacks. The crops of hay, especially of clover and rye grass, are very heavy, as a rule. Lucerne and ryegrass mixed, too, produce great quantities of forage for several years. This plan of growing lucerne is to be recommended, as no hoeing is necessary, and as the mixture makes excellent food for cows or horses.

The production of other early vegetables than potatoes and of fruit in Jersey is an important industry, though in comparatively few hands. On the other hand, the growth of apples, pears, and other outdoor fruit is rapidly diminishing. The table of crop-areas previously given does not include those of orchards, market gardens, and nurseries. In 1887 Jersey had 1,015 acres in orchards, 97 in market gardens, and 23 in nurseries; while the corresponding figures for 1886 were 1,165, 174, and 36, thus showing considerable decreases in a single year. As to bush-fruit, only 56 acres were returned as grown in orchards, between trees, last year. The apple orchards have been greatly neglected of late, and are fast disappearing. They are now chiefly valued for the making of cider. Pears, for which the island has long been famous, are still grown to a limited extent, but many fruit-growers have done away with their pear trees to make room for glass-houses.

Small farmers in Jersey do not, as in Guernsey, build glass-houses for the production of early fruit and vegetables, and that branch of industry is chiefly in the hands of a few extensive growers. One of these, Mr. George Bashford, of St. Saviour's, is deservedly famous as one of the most successful managers of glass-houses in the world. Everything that I saw in his numerous houses on each of two visits paid to him this year was flourishing, failure being apparently unknown to him. He has now nearly thirteen acres of land occupied with glass-houses, and the borders necessary for the vines in most of them, and the heating pipes he uses measure about fifteen miles in length. Tomatoes and grapes are his most important crops,

both being grown in the same houses, as a rule, till the vines cover the glass, after which the houses are devoted to grapes. In some houses, however, vines are not planted. Last year, Mr. Bashford sent 80 tons of tomatoes and 25 tons of grapes to England, and this year he expects the totals to be 100 tons of tomatoes and 25 tons of grapes.

On the occasion of my first visit on March 12 of this year, a few tomatoes in hot-houses had already been picked, and 22,000 plants were about to be put in between rows of potatoes in cool-houses, in addition to a number previously planted. On my second visit, at the end of the third week in June, these tomatoes were bearing fruit, some ripe, and making a splendid show, the potatoes grown with them having been dug and exported. The bulk of the tomatoes grown in heat begin to yield an abundance of ripe fruit by the end of March or early in April, and keep on producing till the end of June, when the fruit in cool-houses should begin to come in. It is usual to grow a crop of late tomatoes in the hot-houses after the early crop. Tomatoes are also grown after cucumbers, for winter use.

The hot-house grape season is reckoned to begin in October and end in May, and Mr. Bashford has a constant supply, I believe, ready to send away during the whole period, as he has special facilities for storing his fruit, having built two houses for the purpose, with double walls lined, as are floors and roofs, with sawdust to keep out frost. One of these is fitted up for the reception of 10,000 bunches, which are preserved by putting the stalks in bottles of water, placed in a slanting position on laths, the grapes hanging down from the necks of the glass bottles. A similar house holds 2,000 bunches. It is usual to put the grapes in these houses about the middle of December, and they can be kept there, if necessary, till February, when the price is usually high. March and April are the months in which prices are highest; but the supply for those months is grown separately by Mr. Bashford, the fruit being ready to be cut during that period, usually about two tons. Some of the glass-houses, it should have been mentioned, are 680 feet long.

Mr. Bashford grows a large quantity of potatoes under glass, some in heat and others without. The heat, however, is not for the potatoes, but for the tomatoes grown with them in alternate rows. It does not pay, he says, to force potatoes, and those grown in the hot-houses are planted later than the others, no attempt being made to force them to come to maturity earlier than the tubers in cool-houses, as the yield is diminished by forcing. In cool-houses, Mr. Bashford reckons his average yield is at the rate of 11 tons per acre; but he has grown 11½ *cabots*

per Jersey perch, or nearly 20 tons per acre. Potatoes grown under glass without artificial heat should be ready for market by the end of April or early in May, just before the outdoor crop is begun; but some growers force the tubers for sale in January and up to April.

French beans are grown between rows of tomatoes in heat, for picking in January and February. Peas are produced in cool-houses only for picking early in April, and up to the time when outdoor produce is ready.

Having briefly described the largest and best of the fruit and early vegetable gardens in Jersey, it is not necessary to refer to others. Mr. Bashford grows a few choice pears; but glass will soon cover the diminished ground occupied by the trees. Judging from what I learned of the quantities and prices of his produce, I have no doubt that his money returns from 13 acres of land greatly exceed those of an ordinary English farm of 1,300 acres. He does not wish his prices to be published; but a few quotations of wholesale prices in Covent Garden Market at different periods of the year may be useful to young producers.

Tomatoes realise the highest prices in February and March, when the wholesale quotations in Covent Garden are commonly 2*s*. to 3*s*. a pound, falling to 1*s*. to 2*s*. in April, 1*s*. to 1*s*. 6*d*. in May, 9*d*. to 1*s*. in June, and 3*d*. to 4*d*. in the autumn, and rising to 1*s*. in January. Grapes (from cool-houses) range from 8*d*. to 1*s*. in August and September (when outdoor produce from wine-producing countries sell at 3*d*. to 8*d*.) to from 4*s*. to 12*s*. in March and April. Potatoes realise 6*d*. to 1*s*. a pound in January, and get cheaper as the season advances. French beans sell at 2*s*. to 2*s*. 3*d*. a pound in January and February, and peas in the pod at about 1*s*. in April and May. Prices vary with the season to some extent; but those given were mostly obtained last year.

But little space is available for reference to live stock and dairying in Jersey. It is not necessary to describe the famous breed of cattle, now more extensively bred in this country than in its native island. The number has fluctuated during the last twenty years between 10,000 and nearly 12,500. The figures from the Agricultural Returns for cattle and other live stock for 1867 and 1887 are as below:—

Live Stock in Jersey	1867	1887
Cattle	10,081	12,474
Agricultural Horses	2,427 (in 1869)	2,400
Sheep	529	349
Pigs	5,804	5,134

The accuracy of the return of cattle for 1867 is doubtful, because the number in 1866 was put down at 12,037, while in 1868 it was 12,225, and a reduction of over 2,000 in the intervening year is improbable. The number of cattle between 1868 and 1887, at any rate, has not materially increased, while there is a decrease in sheep and also in pigs. Horses were not enumerated till 1869.

That the system of tethering cattle, universal in the island, is an economical one is beyond doubt, and the chief objection to it is the torment which tethered animals suffer during the fly season. There is no sheltering under hedges or in the shade of trees to escape either from the flies or from the hot rays of the summer sun. It would probably pay well to keep the cattle indoors during the heat of the day in the hottest weather. Formerly it was customary to keep the animals out all night from some time in May till the end of October; but the owner of the largest herd that I visited informed me that this is not the custom now. Formerly cows were managed so as to calve in the spring; but now calving may be said to go on all the year round, winter dairying being profitable in a place so well suited to it as Jersey is.

The prices of Jersey cattle, after getting up to a high standard, have fallen to pretty nearly the rates current thirty years ago. In 1859, Colonel Le Cornu gave 12*l.* to 14*l.* as the price of a two-year-old heifer, and now it is 12*l.* to 15*l.*; while the price of a first-rate four-year-old cow was about 25*l.* in 1859, and is so still, though fancy prices are still occasionally given for show animals. The foreign demand, which was so active a few years back that prices were much higher than those above given, has greatly slackened of late, chiefly because Jerseys have been extensively bred for some years in America and elsewhere; and, of course, the English demand has fallen off for the same reason. Space is not available for the description of the herds visited during my stay in Jersey. One of the best I saw was that belonging to Mr. Edward Denyze, who has forty cows in milk. The principal strains represented in this herd are Young Prince (182), Bobby (208), and Jersey Boy (92). All the young stock now on the farm are by the same bull, Browny's Perrôt 1st (677). I saw also some excellent cattle on the farm belonging to Mr. Albert Le Gallais, of St. Brelade's, and a smaller number belonging to Mr. J. P. Marett, of St. Saviour's. Among other well-known herds are those of Mr. Philip Labey, of Granville; Mr. J. A. Desreaux, of St. Mary's; Mr. W. Alexander, of St. Mary's; and Mr. H. J. Langlois, of St. John's.

No change has taken place in the prevailing system of butter-

making in Jersey. The old box churn is still in general use, though a few farmers use the barrel churn. As a rule, too, the milk is set in deep crocks or other vessels, and sour cream is churned once or twice a week. There are, however, a few of the now well-known Jersey creamers in use. The butter is churned into a lump, and salted after it has been taken out of the churn. One point of merit is that large wooden spoons are used for the working of the butter, and not the hands; but that is a very old Jersey practice, and in former times was one favourably distinguishing the butter-makers of the island. Cold water is used in thus working the butter, to cleanse it as far as is possible after it is in a lump—which is not very effectively—from butter-milk.

Jersey people think a good deal of their butter, and some of it is good, though the bulk is not. The best farmhouse butter I tasted in the island was that made in the dairy belonging to Mr. Le Gallais, of St. Brelade's, which is sent regularly to a London dairyman. The butter served at two of the best hotels in St. Heliers, at one in March, and at the other in June, had none of the delicate flavour of good fresh butter. There is one dairy factory in Jersey, in Trinity parish, not far from St. Heliers, belonging to Messrs. Griffin & Co. The farmers who supply milk to the factory are paid 8*d.* a gallon, and get part of the separated milk back at half price, the rest being made into cheese—the only cheese that I heard of as being made in the island. A Laval separator, to deal with 70 gallons of milk per hour, a Waide's end-over-end churn, a Lundh (Norwegian) butter-worker, and the Delaiteuse are worked by a small steam-engine. The butter, made in accordance with the most approved modern system, is excellent. The dairymaid was trained in one of the English or Irish dairy schools.

It is commonly said that a country inhabited by small owners and cultivators of land is usually denuded of trees. This is not the case in Jersey. On the contrary, the island is well-wooded, and in many parts there is quite an extraordinary number of trees of fair size by the roadsides. The inside hedgerows contain a great many more pollards than the late Mr. Mechi would have liked to see, woodlands being so scarce in the island that the people are glad to preserve trees for lopping. For the same reason, and also for shelter for crops and live stock, the hedges are allowed to grow high. To the English farmer, accustomed to trimly-clipped whitethorn hedges,—though these are not common in many parts of England—the rough fences in Jersey, studded with pollards, appear unsightly; but they add to the picturesqueness of an island in which utility is certainly not neglected.

The future of farming in Jersey is just now somewhat doubtful, its recent high standard of prosperity having depended to a very great extent upon the remunerativeness of the potato crop. Whether the pre-eminence in the growth of this crop which the island has long enjoyed will be maintained or not, cannot be stated with certainty. If not, and if consequently the enormous land prices and rents of Jersey should fall, there is still no reason to doubt that a country so favoured in respect of climate, and inhabited by as industrious and energetic a race of farmers as it has ever been my pleasure to meet with, will in one way or another continue to hold a foremost place in the agricultural world.

Guernsey.

The total area of land and water in Guernsey is about 16,000 acres, of which about 10,000 acres, a slightly smaller proportion than in Jersey, are under cultivation. The climate is somewhat less genial than that of the larger island, frost in spring being less uncommon. But the chief drawback to Guernsey as compared with Jersey is that the "lay of the land" is quite different. Instead of sloping downwards towards the south, as Jersey does, Guernsey has the highest land on the south side, and the slope is toward the sea level on the north. This, more than any difference in soil—which is formed from rocks of the same characters as those of Jersey—renders the land somewhat less fertile than that of the sister island. Besides, Guernsey is not so well wooded as Jersey is, while the fences are more untidy, and the farming, apart from glass-houses, is less "intense." The difference in rents alone would suffice to show that less is got out of the land in Guernsey than in Jersey, as far as ordinary farms are concerned; but this is chiefly because of the great returns of the potato crop in Jersey, and it by no means follows that the farmers who get the greatest returns secure the largest profits. The keen competition of Frenchmen who desire to rent land is scarcely at all felt in Guernsey, so that rents are not there, as they have become in Jersey, the margin of profit beyond the cost of the meagre subsistence which satisfies a Brittany peasant.

Unfortunately, when we come to official statistics, we must reckon Guernsey with the smaller islands that make up its bailiwick. In 1887 there were in the Guernsey bailiwick 1,553 occupiers owning the land they farmed, and 520 renters; the former holding 6,601 acres, and the latter 5,172 acres. Thus in Guernsey and the smaller islands the occupying owners are more than three times as numerous as the tenants,

whereas in Jersey the two classes are nearly equal. It will be noticed that the preponderance of acres owned by the occupiers is much less than that of the number of owners. This is partly accounted for by the fact that in Alderney a large proportion of the land is rented, and in one small island the whole of it. But the chief reason is that there are a great many freeholders who own only an acre or two, or sufficient for a house, garden, and glass-house. Indeed, a great many working-men buy as little as half a *vergée* (nearly $2\frac{1}{2}$ Guernsey *vergées* to the acre) for a green-house. This latter fact also explains the very small average of land to each occupier. The total area of occupied land in the bailiwick of Guernsey in 1887 was returned at 11,773 acres, and the total number of occupiers (owners and tenants together) at 2,506. Thus the average area of a holding is only a minute fraction over $4\frac{2}{3}$ acres, as compared with about $7\frac{1}{2}$ acres in Jersey. According to "Gardner's Guide to Guernsey," the population of the island in 1881 was 32,607, of whom nearly 17,000 resided in St. Peter Port. This gives an average of 1,300 people to the square mile for the whole island, a density described by the book referred to as nearly three times that of any other European State. The population had increased since 1871 by a little over 2,000. These figures relating to population refer to Guernsey alone. The large number of residents from England, living on their property, must add considerably to the agricultural prosperity of the island.

The laws and customs affecting the inheritance and sale of landed property are almost precisely the same as in Jersey, though there are a few variations in the values of and rates of interest on the *rentes* and in the privileges of the eldest son in the two islands. Farm-rents in Guernsey range from 3*l.* to 10*l.* an acre, the most common amounts being 6*l.* to 7*l.*, or about 3*l.* less than in Jersey. Of course, where there is a good house, with a glass-house as well, on a small spot of land, the rent would be higher than the extreme given above as that paid for agricultural land.

A comparison of the cropping of the bailiwick of Guernsey in 1867 and 1887 is given on p. 389.

The decrease in the cultivated area (crops, fallow, and grass) must be owing partly to the relinquishing of attempts to cultivate two of the smaller islands. Certainly in Guernsey itself there are no signs of land having gone to waste. On the other hand, the increased area occupied by dwellings and gardens in the island has, of course, been taken out of the agricultural land.

Comparing the following table with the corresponding one

Crops in Guernsey, &c.	1867	1887
	Acres	Acres
Wheat	968	456
Barley	623	399
Oats	449	540
Rye	30	12
Beans	37	26
Peas	50	5
Total Corn Crops	2,157	1,438
Potatoes	789	877
Turnips	142	89
Mangolds	244	247
Carrots	221	190
Cabbages, rape, &c.	152	15
Vetches, lucerne, &c.	1,527	1,459
Total Green Crops	3,075	2,877
Clover, &c., and grasses under rotation	874	1,423
Permanent pasture	6,143	5,280
Bare fallow	709	23
Crops, bare fallow, and grasses	12,958	11,041

for Jersey, it will be seen that the figures for Guernsey and the smaller islands show a greater proportionate falling off in corn crops than those for Jersey; that the green crops, exclusive of clover, &c., have decreased instead of increasing, as in Jersey; that the increase in clover and grasses under rotation is much greater in the Guernsey bailiwick than in Jersey; and that there is still a much greater proportion of permanent pasture in the former than in the latter.

The figures serve to emphasise what has already been said as to the inferior " intensity " of Guernsey farming, although it is always to be borne in mind that in such statistical comparisons Guernsey proper suffers seriously by having Alderney, Sark Herm, and Jethou reckoned with it. With all due allowance, Guernsey land as a whole is not as highly farmed as that in Jersey. When we come to the glass-houses, however, we have an " intensity " not touched in Jersey by the small farmers. In some parts of Guernsey nearly every farmer, as well as many a mechanic or other workman, has at least one glass-house, and many have several of these structures.

Before referring to what is done with the glass-houses, a few details about the fields may be given, and for these I am indebted chiefly to Mr. Le Patourel, of St. Sampson's; Mr. Mahi, of the

same parish; and Mr. Le Pelly, of St. Andrew's; while Mr. De Mouilpied, of St. Peter Port, afforded me a good deal of information as to the best farms to visit. The old course of cropping, still pursued by a few farmers who disdain modern innovations, is one of grass or "seeds," wheat, parsnips, potatoes, roots—prolonged sometimes by growing roots or some other feeding crop two or three years before returning to grass or seeds, in which the land rests two or three years. The more usual course now is one of grass or seeds, parsnips, potatoes, and broccoli or turnips (planted as soon as the potatoes are off), and potatoes again, with or without broccoli to come after them in the same year. *Broccoli* is now one of the most profitable of the crops grown in Guernsey, and it will be noticed that it takes an important position in the new course of cropping, while wheat is left out.

On a well-cultivated farm in St. Andrew's parish, belonging to Mr. Le Pelly, who keeps twelve splendid milking cows—Guernseys, of course—and sells the milk in St. Peter Port, the rotation pursued is (1) wheat, (2) parsnips, (3) vetches and turnips, (4) oats, with which clover, lucerne, and ryegrass are sown, to stand for six or seven years. Mr. Le Pelly rears and fattens all his calves. I may mention, in passing, that he told me he never dried off his cows, and other Guernsey farmers said the same, giving as a reason that when the animals are feeding on an abundance of succulent food, there would be danger of milk fever if they were dried; but some cows cease of their own accord to yield an appreciable quantity of milk for a few weeks before calving, and they are dried off. Mr. Le Patourel, however, informed me that it was the general custom to dry off the cows for a few weeks.

The wholesale price of milk in Guernsey is 1*s.* a gallon ($13\frac{1}{4}$ cubic inches smaller than the English Imperial gallon) all the year round.

Mr. Le Pelly has eighty-five *vergées*, or thirty-four acres, of land, which constitute one of the largest farms in Guernsey. He stated that there was only one farm of 100 *vergées* (40 acres) or more in the island, probably referring to Mr. Le Patourel's farm, which is about 50 acres in extent. It will be seen from his rotation that he grows a good deal of "seeds," and he needs a considerable quantity of fodder for his cows and bullocks; but he also makes hay, and as he sold some this year at 7*l.* a ton, its production is not unprofitable. He grows potatoes for export on about 4 *vergées* of land, and turnips after them, year after year—that is, on the same piece of land. Broccoli he also grows for export, and his last crop was sold as it stood at 36*l.*

per acre; but as there are nearly 10,000 plants to the acre, and the heads commonly sell at $1\frac{1}{2}d.$ each in London in the middle of March, or at $1d.$ clear of all expenses for carting and freight, a crop often realises 40*l.* an acre.

For his farm alone, Mr. Le Pelly told me, he would require four men, besides himself; but he employs more hands, including his son or sons, as he has other business on hand besides farming. In addition to selling milk in the town, he makes a large quantity of cider for sale, buying the apples of his neighbours for the purpose. He built an excellent glass-house last year, at a cost of 230*l.*, and grew tomatoes in it the first season which realised 74*l.* As an instance of the value of fairly good land in Guernsey at a distance of a few miles from the chief town of the island, I may mention that Mr. Le Pelly recently paid 300*l.* in cash (not the most common method of purchase) for not quite $2\frac{1}{5}$ acres.

All authorities agree that Guernsey farmers make their farms pay only by working with the men, when they employ any. But this is not all, for they are at work long before the hired men come on to the farm, and after they leave. The labourers' hours are from 7 A.M. to 6 P.M.; but the master, Mr. Le Patourel says, is often at work from 4 A.M. to 9 P.M. in the spring and summer. Wages on farms average about 3*s.* a day, with 10*d.* extra when the men work two hours overtime, that is till 8 P.M., in busy seasons.

A good deal of straw is imported, and some hay; but most of the latter consumed in the island is grown there. Potatoes for winter use, as well as new potatoes for export, are grown in Guernsey.

An inspection of some of the green-houses (or cool-houses) belonging to small growers of fruit and early vegetables was very interesting. Mr. Le Patourel has four of these houses, in which he grows grapes, potatoes, and tomatoes, without artificial heat; as the term "green-house," as opposed to hot-house, implies. Potatoes are grown before tomatoes, and grapes commonly in the same houses; but when the grapes cover the glass, the houses are devoted to them only. As tomatoes pay at present much better than unforced grapes, however, many of the constructors of new green-houses do not plant vines in them; or, if they do, they adopt the method noticed in one of Mr. Le Patourel's houses—that of keeping the vines cut low down, so that they may serve chiefly as an insurance in the case of the tomato crop failing to grow or to pay.

Some of the best managed of the cool-houses that I visited, were four belonging to Mr. Robin, of the Vale, who has about

six *vergées* (not quite two and a half acres) of land. In one of these, 108 feet long and 36 feet wide, he had a splendid crop of tomatoes, which some one had offered to take at the market price of three tons of fruit. A good many of the tomatoes were ripe, and they were selling in the last week of June at 10*d.* to 1*s.* a pound in London, I believe. The average value of the whole crop might very safely be put at 60*l.* a ton, as it was an early crop, and the fruit was very fine: so that the gross returns for the produce of a second crop (following potatoes) in this one house would be at least 180*l.* Probably the total was a good deal more than that amount; but the crop was an extraordinary one, and there is the cost of freight and commission to come off. Mr. Robin grows his plants in rows 2 feet 9 inches apart, and 18 inches from plant to plant, in the rows. As an instance of making the most of the land outside the green-houses, I may mention that I noticed a plot on which parsnips and carrots had been sown with radishes. The last were first taken up, and the carrots were ready to be taken up when I was there, leaving the parsnips. Rents in the Vale, a famous fruit-growing district, are from 2*l.* 10*s.* to 3*l.* per *vergée*, or 6*l.* 5*s.* to 7*l.* 10*s.* per acre, for holdings of fair size, and up to 8*l.* per acre for small, and even 9*l.* for very small pieces of land.

Another Vale farmer, Mr. Bisson, grows melons and cucumbers, of course with heat, and grapes and tomatoes with and without heat. A few days before my visit, when potatoes were quoted at 2*s.* to 3*s.* per *cabot* at the outside, Mr. Bisson realised 6*s.* 8*d.* per *cabot* for some that he sent in small packages to Covent Garden; but his tubers were full-sized and well grown. There is no doubt that many Jersey growers do themselves harm by sending a lot of under-sized tubers mixed with the fair sized ones; and as their regular custom is to put some of the biggest on the top of each barrel, buyers are apt to discount their produce by making a full allowance for what is expected to be found underneath.

Four or five companies have recently been formed to grow, in St. Sampson's, near St. Peter Port, early vegetables and fruit for export, and all but one are supposed to be paying well. I visited three of these very interesting establishments, and greatly regret that space will not allow of a full description of what I saw in them and learned about the system on which they are worked. It may be pointed out that any one who intends to go in for glass-houses would do well to visit these establishments, in order not only to see how forced vegetables and fruit are grown for market, but also how, in two of them at least, glass-

houses can be constructed in the most economical manner. Two if not three of the companies employ the same manager, Mr. Bulgaize, who appears to know how to make the undertakings pay. His method of growing tomatoes is a peculiar one, as far as my limited experience enables me to judge. It is not nearly as pretty to look at as Mr. Bashford's, and it seemed to me that the plants were far too thick, so as to half smother each other; but the test of results is the only one of importance, and it is not for an outsider to criticise in positive terms an experienced grower. In some of the houses of the Guernsey Fruit Growers' Company, which were begun only in August 1887, and are in sets of spans without inside divisions, costing only 5*d.* per square foot, French beans were grown in alternate rows with tomatoes, and after the beans were picked, the plants were taken out and tomatoes put in their places. There were then tomatoes in rows 3 feet apart, and 1 foot from plant to plant in the rows. This is very thick, and the only explanation of such thickness is that the plants are not allowed to grow more than about 3 feet 6 inches high, or to produce more than a few clusters of fruit each, the idea being to get the fruit which comes first quickly ripened, and then to uproot the plants and put in others, so as to obtain two or three crops in a season. Melons and grapes are to be grown after this year.

The Guernsey and Jersey Fruit and Produce Company has been established three years, and its establishment appeared to me to be the best worth seeing of any that I visited. Two crops at least are grown in a season in every house, and three of some kinds of produce, such as tomatoes. No grapes are grown. The chief crops are tomatoes, melons, cucumbers, potatoes, French beans, and roses. About 30 tons of tomatoes are produced in a season, and 7,000 to 8,000 melons. A splendid crop of melons had just been picked, except a few of the latest, in the last week of June, and a second crop was to be ready in September. After that cucumbers would be put in, for cutting in January and February, then melons once more, and so on. In this way two crops of melons and one crop of cucumbers are obtained in twelve months from the same houses.

The great number of hot-houses and green-houses in Guernsey make work for a large staff of employés. In the busy season men employed in them are paid 4*s.* a day, and women 2*s.* 6*d.*

The exports of vegetables, fruit, and flowers from Guernsey in 1887 were given as follows at the last annual meeting of the Guernsey Chamber of Commerce:—

Exports from Guernsey	Packages	Price	Value
		£ s. d.	£
Radishes and broccoli . .	37,000	0 5 0	9,250
Grapes	75,000	0 10 0	37,500
Tomatoes	92,000	0 6 8	30,000
Flowers	23,000	0 2 6	3,000
Potatoes	50,000	0 8 0	20,000
Mushrooms	400	0 10 0	200
Total	277,400	—	99,950

The increase over the exports of 1886 was upwards of 37,000 packages, and the number has nearly doubled since 1883. The weight of the grapes is estimated at 502 tons, and of the tomatoes at 1,000 tons. It is strange that there is no mention of peas, beans, melons, cucumbers, or figs, all exported in considerable quantity. Apparently the values do not include the cost of conveyance to and sale in London, as the tomatoes come to less than $3\frac{1}{4}d.$ a pound, which is a very low price. They certainly make more than that average price in London.

Being a great admirer of the Guernsey breed of cattle, it was a pleasure to me to inspect a few of the herds in the island. Mr. Le Patourel, who is the principal shipper of cattle in Guernsey, has a remarkably fine herd of twenty milch cows, and a few bulls and young stock. The old Excelsior (by Fair Lad) and the Climax strains are represented in the herd, in tracing descent from bulls, and the Elegans, Cornucopœa, and Bonny Lassie families, in tracing from cows. The famous herd belonging to Mr. James, of Les Vauxbelets, was dispersed by auction in England while I was in Guernsey. Mr. Le Pelly's herd has already been referred to in connection with his farm. The Excelsior strain is represented in that as well as in Mr. Le Patourel's herd.

One of the best small lots of cows I saw was that belonging to Mr. Edward Weedon, who lives about a mile from St. Peter Port. He has a fine bull, Vulcan V., which he says is the only pure-bred Vesta left in the island, all the rest of the family having been sold to a well-known English breeder, Mr. Christie. It is advisable here to refer again to an excellent mixture noticed as grown on Mr. Le Pelly's farm, as it was found on Mr. Weedon's farm also, and is much in favour in the island—one of clover, lucerne, and ryegrass, sown to lie for six or seven years. Mr. Weedon's farm of fifty *vergées* well repaid inspection, as it is excellently cultivated. Strawberries and flowers are among the crops.

Mr. Mahi, of the Vale, and Colonel Gifford, of St. Sampson's,

also have some capital specimens of the Guernsey breed. Mr. le Carré, of Les Blicqs, St. Andrew's, is especially well known as a breeder. The Lady Jane strain is one of the most famous represented in his herd. Mr. G. Le Page, of Catel, and Mr. Prevost, of the same parish, should also be mentioned in this connection; but there are other notable herds which did not come under my notice, and two or three of those named above had to be left unseen. I was much struck with the generally high standard of excellence in the Guernsey cows that I saw. The uniformity of type is certainly greater than it is among the Jerseys, and it seemed to me that the same might be said of the standard of merit.

The numbers of the several classes of live stock in the bailiwick of Guernsey for 1867 and 1887 compare as follows:—

Live Stock in Guernsey	1867	1887
Cattle	7,308	7,813
Horses.	1,923 (in 1869)	1,502
Sheep	1,348	566
Pigs	6,718	4,035

It will be borne in mind that these numbers include those of animals kept in Alderney, Sark, and the smaller islands. As in Jersey, there is a considerable decrease in the number of sheep and pigs.

There are no better butter cows in the world than the Guernseys, and the people of the island appear to think that they make the best use of them. So long as they get 1*s.* 6*d.* a pound for butter in the cheapest season, and 2*s.* for a great part of the year, they may well be satisfied, and have no need to change a system under which they, in reality, dispose of a considerable quantity of cheese at those high prices. By churning the whole milk, soured, and churning it into a lump, they necessarily work a substantial proportion of caseine into their butter, which is decidedly too solid and cheesy. Its fine natural colour makes it attractive in appearance, and the Guernsey residents will give more for it than for any other butter. The old dolly churn is still generally used, though Englishmen in the island and a few Guernsey men have the barrel churn. There is no dairy factory in the island.

The cart-horses in Guernsey, as in Jersey, are small and carelessly bred. I do not remember having seen a sheep, and the pigs escaped my attention.

Alderney.

To Alderney I paid a visit, but not to Sark—which is, I believe, well worth seeing—or the smaller islands (Herm, Jethou, Brechou, Lehou, and Burhou), which are not at all important from an agricultural point of view, and need not be further referred to. Alderney has a deserted appearance, owing to the houses of the farmers being all, or all but three or four, in the little town of St. Ann's. The absence of trees, too, adds to the desolate appearance of the island, which, however, is by no means devoid of natural fertility. Its exposure to the winds of the Channel is, of course, against its cultivation for many purposes, and it is chiefly devoted to the feeding of cattle, though some parts of it are tilled. The total area is 1,962 acres, and the inhabitants in 1881, including the military and their families (517 persons), numbered 2,048, as compared with 3,333 in 1851.

To Mr. Shade, the cattle exporter of the island, I am indebted for most of the information I obtained about it, and for his kindness in driving me to all the farms worth seeing. The rent of good land is usually 2*l.* a *vergée*, or 5*l.* an acre; but 50*s.* an acre is a more common rent, and how the farmers make the land pay at even the smaller sum is a mystery, as they appear to export scarcely anything besides a few cattle. The land is a great deal subdivided among owners, and by far the greater part of it is let. Wheat (nearly all bearded) and oats are grown a good deal on the cultivated land, as well as mangolds, parsnips, carrots, potatoes, vetches, and lucerne. I noticed some tremendous crops of lucerne and ryegrass mixed. From 20 to 23 bushels of wheat per acre would be reckoned a good crop. Potatoes are allowed to grow to their full size, for winter use, none being exported.

There are several rather large farms, chiefly in grass, on which 25 to 50 cows are kept. Mr. Barker, an Englishman, who has 25 cows, and has gained the first prize for two or three years for bulls, was good enough to show me his farm and his herd, which is a very good one. He has sent most of his surplus cattle to England. One of his cows, which had calved a month, was said to be giving 20 pots of milk a day, equal, I believe, to about 40 pints. I was much struck with the healthy and hardy appearance of the Alderney cows, and with the excellent bags which they nearly all have. The breed is now scarcely distinguishable from the Guernseys, except that the standard size of the Alderneys is a little smaller than that of the other breed. But as the Guernsey people have always

freely imported Alderney cows, though not the bulls, the breeds are practically identical. It is not long since Jersey also received Alderney cows. There are, however, still some black cattle in Alderney. The breed had black points originally, but as the Guernsey breeders will not buy cows with black points, only white-nosed bulls have been used in Alderney for some time past, so that black points are nearly extinct.

Alderney has a great disadvantage in not being able to ship to England without transhipping at Guernsey. It would probably pay the farmers to co-operate in buying and using a cargo-boat, for there is obviously a great deal of undeveloped wealth in Alderney. Possibly, however, the people of the island are quite as happy in their comparatively easy-going and primitive mode of living as their more enterprising neighbours in Jersey and Guernsey.

XXI.—*The Propagation and Prevention of Smut in Oats and Barley.* By J. L. Jensen, Copenhagen.

[Communicated by Charles B. Plowright, F.L.S., King's Lynn.]

The disease of cereals known as smut (*Ustilago segetum*) is, I believe, regarded in some parts of the country, in Norfolk for example, with a superstitious reverence: as in bygone times the black ears were considered to increase in some way the yield of the crop. I found, however, in forty fields of barley and oats in different parts of Denmark, that on an average 4 per cent. of the barley and 8 per cent. of the oat plants were destroyed by it. This represents an average loss of 3*s*. and 6*s*. per acre respectively, which is equal to about 20 per cent. of the rent, so that in these days the subject is worthy of consideration by the practical agriculturist.

A. Propagation of Smut.

I. The spores of smut (*U. segetum*) falling on the ground in a cornfield during the summer and autumn will not to any appreciable degree affect barley and oats grown in that field in the ensuing season. This is indirectly proved by the fact, which will be hereafter demonstrated, that those spores of the fungus which adhere externally to the seed-corn, however numerous they may be, are practically incapable of infecting the young plants. It is directly proved, however, by the following facts:—

On the Experimental Farm of the Royal Agricultural School near Copenhagen, there is a plot upon which barley has been

continuously grown for nearly thirty years; and there also is a similar plot on which barley is grown every fourth year, in the following rotation, wheat, mangolds, barley, beans. In wheat smut never occurs, because the seed-corn is dressed with sulphate of copper. Now, if it were true that the spores which fell upon the ground were capable of producing the disease the following year in the crop, we should find the disease more prevalent in the first-mentioned plot than in the second, provided they were both sown with the same seed-barley. In 1885 and 1886 the smutted ears were computed in the following manner: I walked slowly down the two plots for a distance of 120 yards, counting as I went along all the smutted ears which I could see on my left hand as I went, and on my right as I returned, with the following result:—

	Left	Right
In the plot sown every year with barley,	86 smutted ears;	77 smutted ears.
In the plot sown every 4th year „	266 „	302 „

Although by this means absolutely accurate results could not be obtained, yet it is conclusively shown that, contrary to what one would have expected, the plot which had been continuously cropped with barley was the most free from the disease.

In 1886 a more exact method was adopted—namely, the percentage of blighted ears was determined in the two plots with this result:—

8,000 ears with plot continuously sown with barley, .	70 smutted ears.
8,000 ears with plot sown every 4th year with barley .	130 „

The result was therefore the same; there was much less smut in the plot continuously cropped with barley, than in the one in which it was grown every fourth year.

It has been often asserted that dressing seed-corn for smut is practically without benefit, because the crop becomes diseased from the spores which have fallen upon the ground, unlike bunt (*Tilletia tritici*), in which disease the plants are infected from the spores adherent to the seed. The above observations, however, show this assertion to be incorrect. Further, the eminent Danish botanist Mr. P. Nielsen has tried to preserve the spores of smut by burying them at different depths in the ground. He experimented with myriads of spores, but found that, without exception, they all lost their power of germination between the end of summer and the following spring.

Although the two plots above mentioned were sown with the same seed-corn, yet that which had been continuously cropped with barley had less smut in it than the other. This requires some explanation. When the young barley plants are attacked by *U. segetum* they become truly diseased, some to

such an extent that they die and produce no ears, others—less severely attacked—produce a smaller number of ears than sound plants would do. Plants grown in an impoverished soil, such as would be produced by 25 years' consecutive cropping, have less vitality to withstand the disease, so that not only do more die outright, but those which survive produce a smaller number of ears. Thus, I found 100 barley plants affected with smut produced only 152 ears, all of which were diseased; while 100 healthy plants growing beside them, and taken indiscriminately, produced 260 ears. The length of the straw was also diminished, for 100 blighted straws measured 5,843 centimetres, while 100 sound straws from contiguous plants, taken indiscriminately, measured collectively 6,522 centimetres; so that on an average each healthy straw was about three inches longer than those produced by smutted plants.

This shows that smut has a more detrimental effect upon the vegetative system of its host-plant than even bunt has. For the celebrated French botanist Tillet found that

1,411 bunted wheat plants produced 4,521 ears = 3·20 per plant;
1,732 sound wheat plants produced 5,454 ears = 3·15 ,,

while Mr. P. Nielsen and myself found that wheat plants infected with bunt produced on an average a few more ears than sound ones did. Moreover, smut destroys not only the grain but also the chaff, while bunt leaves the chaff and external coat of the wheat untouched. I find, however, that bunt reduces the length of the straw in about the same ratio as smut does.

II. The spores of smut in farmyard manure, when applied to the field, will not to any appreciable extent infect oats and barley.

The eminent German botanist Brefeld has asserted that the spores of the *Ustilagineæ*, when placed in a proper nutritive medium, such as a sterilised decoction of horse-dung, will develop secondary spores, which, by budding like yeast-cells, multiply themselves until the nutritive material in the solution becomes exhausted. For this reason he considers that farmyard manure is the great means by which smut and bunt are spread. And he supports this theory by stating that practical farmers generally believe that fields manured with fresh farmyard manure are more liable to smut and bunt than when no manure is used.

Although this theory of Brefeld is very plausible, yet my investigations and experiments show it to be untenable as far as barley and oats are concerned. First, because, as will be shown below, the spores of *U. segetum* adhering to the exterior of the seed-corn do not to any appreciable extent cause the crop

to be affected. Secondly, while it may be quite true that farmyard manure when applied to fields causes the crop to have more smut in it than is the case in unmanured fields, yet this arises from the manure increasing the fertility of the land, and not from the introduction of smut spores. Nor does it matter in what way the fertility is increased, whether by farmyard or by artificial manure, or by the system of cropping, the result is the same.

That this is true the following facts show:—

(*a*) In the plot, which we may call the Permanent Barley Plot, previously referred to, there was one portion which was heavily treated with farmyard manure annually for more than 25 years. It is true that this portion had a considerably larger percentage of smutted ears than those other portions of the same plot where the crop was poorer, from the soil either being unmanured, or treated with artificial manure from which some essential of plant-food was excluded (nitrogen, phosphates, or potash). But the first-mentioned portion of the plot (that treated with farmyard manure) was not more heavily smutted than the other plot on which barley had been grown every fourth year for the same period of 25 years, and which had never had during all that time any farmyard manure at all upon it, but which, owing to the good system of cropping adopted, produced very good and strong barley.

(*b*) At the side of the portion of the Permanent Barley Plot which was treated with farmyard manure there was a portion which had annually received a compound artificial manure in which all the necessary constituents of plant life were present. Both these portions produced a good crop, although that manured with farmyard manure was a little more luxuriant.

	1885	1886
In the farmyard-manured portion .	42 smutted ears	1·2 per cent. smut.
In the artificially manured portion .	35 „	1·0 „

So that really the proportion of smut was very nearly the same in both cases, and what trifling difference there may have been may fairly be attributed to the difference in the fertility of the two portions.

It is well known to farmers in all countries that as long as the seed-wheat has been properly dressed with sulphate of copper, there is no need for them to fear bunt, inasmuch as it is almost impossible to find a single bunted ear in these fields, whether they have been manured with farmyard or artificial manure. From this fact alone we must conclude that the dunghill plays a very insignificant part in the dissemination of bunt in wheat.

III. Spores of smut adhering externally to the seed of barley and oats are unable, to any appreciable degree, to infect the crop produced from that seed. It is a well-known fact that when the spores of bunt (*T. tritici*) are sown adhering to the seed-wheat the crop is certain to be more or less bunted, and if many spores adhere to the wheat almost every plant will be diseased.

In a field of smutted oat or barley the spores of the smut fungus (*U. segetum*) are swarming in great quantities, and may be found by microscopic examination on all parts of the healthy plants, even upon the kernels themselves. It is also a well-known fact that using seed from a smutted field, unless it be efficiently dressed, will produce a smutted crop; and, moreover, the more smutted plants there are in the field of seed-corn, the greater will be the number of diseased plants produced from its seed.

Up to the present it has always been considered that the cause of this was the spores which adhered to the seed-corn. I have, however, for some years made a considerable number of experiments by sowing the live spores of smut upon oat and barley-seed taken from healthy fields without being able to produce smutted plants, while the crops always became smutted when produced from seed taken from a smutted field. I, therefore, began to doubt whether the adherent spores on the seed-corn could have had anything to do with the production of the disease.

This doubt was strengthened by a communication from Mr. Plowright, in which he told me that in ten experiments with oats he had tried in vain to produce a smutted crop by sowing the seed-corn with the spores of (*U. segetum*) partly with the ordinary spores, partly with the secondary spores before mentioned. In the summer of 1887, I made the following experiments, which bring out this point very clearly:—

A quantity of oats was taken from a field in which more than 40 per cent. of the ears were smutted. It was divided into three portions, A., B., and C.

A. was washed with water and fine sand; each grain was found on examination to have on an average 50 spores adhering to it, and then planted. B. was planted without any preparation; about 8,000 spores adhered to each grain. C. was dusted with spores, so that about 40,000 adhered to each grain, and then planted.

The germinative power of the spores was tested, and it was found that each grain in A. had 25 living spores on it, in B. 4,000, and in C. 12,000.

A quantity of barley taken from a smutted field was treated in the same way.

The above were sown, with the following results:—

Oats.

A.	25 living spores on each grain	produced	29	per cent. smutted ears.
B.	4,000 „ „	„	37	„ „
C.	12,000 „ „	„	36	„ „

Barley.

A. washed, and having very few living spores on each grain	1·6	per cent. smutted ears.
B. unwashed, with many living spores on each grain	1·4	„ „
C. dusted with additional spores on each grain	1·4	„ „

Thus, we see the proportion of smutted ears bears no proportion to the number of spores adhering to the exterior of the seed. The large quantities of the spores dusted on the seed did not increase the number of blighted ears, but the washed oats had a somewhat lower percentage of smutted ears.

IV. Although, as is shown by the foregoing, it is impossible to infect oats and barley with smut spores to any appreciable extent by applying them to the seed-corn, yet there can be no doubt that the spores are the reproductive bodies of the fungus by which smut is propagated in nature. The subjoined table, showing the proportion of smut in 23 varieties of oats during three consecutive years on the Experimental Farm of the Royal Agricultural School near Copenhagen, leaves no doubt as to the unerring certainty with which the fungus is reproduced by nature :—

SMUT IN 23 VARIETIES OF OATS, 1885–87.

Names of variety	Percentage of smutted ears		
	1885	1886	1887
1. Canada	28	30	22 + x
2. Berlie	1	6	9
3. White Steier Mark	1	7	12
4. Potato Oats	1	3	22
5. Oats from Scone	0	2	6
6. Swedish Cub	1	7	7
7. Förslev Oats	0	7	13
8. Avena Strigosa	0	0	0
9. Early from Belgium	1	8	14
10. Fionie	0	6	19
11. White Three-grained	0	0·2	4
12. Great White Tartarian	10	10	37
13. Black Steier Mark	0	9	9
14. Black Swedish	4	5	10
15. Black Tartarian	10	15	20
16. Oats from Grenaa	1	5	14
17. Early Angus	8	7	28
18. Late Angus	2	3	6
19. New Zealand	22	17	21
20. China	5	6	3
21. Blainsly	25	45	75
22. Provsti	1	3	8
23. Experimental Farm	0	4	10

It should be remarked that the seed was taken from the crop after it was cut, while the 23 varieties were lying side by side on the ground, so that there was no thrashing of the smutted and sound ears together. *Avena strigosa* was the only species absolutely free from smut. This, of course, means that

A. strigosa is not liable to the attack of the common oat-smut, for, grown under these conditions, it was as liable to become affected as any other variety.

It is seen from the table that in 1885 six varieties were free from smut. This was because they were grown for the first time on the Experimental Farm, and from healthy seed. The other varieties had been grown for many years. We notice that in the 22 varieties the disease has not failed to transmit itself in a single instance, and upon the whole in an increasing scale.

The main question before us, however, is, In what manner does the propagation of smut take place? To answer this we must take cognisance of the following facts:—

1. The spores of smut ripen and become diffused in the fields of themselves while the corn is growing, unlike the spores of bunt, which remain enclosed inside the kernel until this is ripe.

2. The diffusion of smut spores is most profuse just after the ears have appeared; hence it is most likely that this is the most favourable period for the propagation of the fungus.

3. Since we have seen that spores simply adhering to the exterior of the grain do not to any appreciable extent cause the infection of the crop, it follows that this must take place by means of those spores which succeed in entering the space between the "cosh" or husk and the kernel.

4. As the kernels of oats and barley are tightly embraced by the husk, except where the husk opens to allow the stamens to protrude, it follows that this period is the most favourable for the infection of the grain. This is supported by the fact that the greatest number of smut spores are given off at the time the ears are flowering; and it should be observed that at this period the spores fasten in great quantities on the viscid pistils, to which, of course, the spores have as easy access as the pollen has.

The question presents itself, Does the corn become infected by the spores which are inside the husk germinating directly and sending a mycelial hypha or thread into the ovary, or into the grain, while it is still green and soft? In which case the presence of the fungus does not produce any observable effect until the grain germinates in the ensuing spring. Or do the spores, having gained admission into the husk, remain there quiescent until the grain germinates?

I was unable absolutely to decide this question for some time; but my experiments in the summer of 1887 clearly pointed to the last-named as being the most probable explanation. It is certain, however, that infection takes place from within the husk, and not from without. This is further shown

by several of my experiments with barley, in which all the externally adherent spores were killed, and yet the crop was more or less smutted. If we accept the view that the infection takes place in spring from the spores included by the husk, we shall arrive at the following conclusions:—

1. The experiment mentioned above, in which the washed oats gave a slightly less proportion of diseased plants, may be accounted for by supposing the water entered the space between the kernel and the husk, and washed out some of the spores.

2. If we remove the husk from oats, and apply spores of *U. segetum* to the kernel itself, we should expect the resultant plants to be smutted. During the summer of 1887 I performed this experiment. A quantity of oats was disinfected with warm water in the manner hereafter described. This was divided into four parts, each containing 100 oats. The treatment of each of these lots, and the results of the experiment regarding the smutted plants which were produced from them, were as follows:—

No. 1. Husk removed, spores dusted on the bare kernel, gave . . .	33	ears, of which	4	were smutted.
No. 2. Husk removed, no spores dusted on the bare kernel, gave . . .	53	"	0	"
No. 3. Husk not removed, spores dusted on the outside	50	"	0	"
No. 4. Husk not removed, no spores applied	62	"	0	"

The plants produced by the above seed did not thrive well, partly because they were injured by being bitten off by a stray horse. But it will be seen that only where the spores were applied to the bare kernel were any smutted plants produced, and then four ears were produced from two plants. The total number of plants is, however, too small to render the experiment conclusive.

During the year 1888 I obtained satisfactory evidence that barley and oats become infected by smut from the spores of the fungus finding their way inside the husk (or glumellæ), and not from the entrance of threads of spawn (mycelial hyphæ) into the ovule. A quantity of oats was disinfected by immersion in water at 133° F. It was divided into two equal portions, from both of which the husk (glumellæ) was removed. To one portion (A.) smut spores from an oat plant were applied to the bare kernels; the other portion (B.) was planted without further treatment. The subjoined was the result:—

A. produced	21	per cent. smutted	ears.
B. "	0	"	"

A quantity of similarly disinfected barley was soaked for half an hour in water, and from the kernels the outer coat was removed with a knife. Smut spores from barley were then applied to half the kernels before they were sown (A.); the other half was sown without the application of smut spores (B.). The subjoined was the result:—

A. produced	27	per cent. smutted ears.
B. "	1	" "

I further found that oats can be infected without removing the husk by dipping them into water charged with smut spores, although dusting the dry spores on the seed is as a rule without appreciable result. Thus:—

Oats dipped in spore-charged water produced .	29	per cent. smutted ears.
Oats dusted with dry spores	0	" "

B.—Varieties of Smut.

Is the smut which affects barley, oats, and wheat the same fungus, or are there more than one species of smut? As long as no certain method of infecting these cereal plants with smut was known, this question could not be answered by botanists, because the spores produced on barley, oats, and wheat resemble one another so closely under the microscope as to be practically indistinguishable. Still some botanists have doubted their identity. I have this year conducted some experiments upon this point. Spores of these smuts were applied to the bare kernels of their respective host-plants, with the following results:—

Oat Smut.

		per cent.	
Spores from smutted Oats on bare kernels of oats	gave	21	smutted ears.
" " " barley	"	0	"
" " " wheat	"	0	"

Barley Smut.

Spores from smutted Barley on bare kernels of barley	"	26	"
" " " oats	"	0	"
" " " wheat	"	0	"

Wheat Smut.

Spores for smutted Wheat on wheat kernels . .	"	1	"
" " oats " . .	"	0	"
" " barley " . .	"	0	"

From the above it seems clear that if these smuts are not different species they are at least well-marked varieties, although their spores and the manner in which they germinate are in the present state of our knowledge indistinguishable. To the

practical farmer this information is of importance, as there is no fear of adjacent fields sown with different crops infecting one another: a smutted barley field, for instance, will not infect a field of oats, or *vice versâ.*

I further find, however, that there are two distinct species or varieties of smut which affect barley. One, the commoner, completely destroys the entire ear, including the outer envelope of the kernels, so that in a week or two the spores are scattered by the wind, leaving the rachis bare. The affected ears emerge from their sheaths in the same way as healthy ears do, namely from the top. This I propose to call *Ustilago segetum*, var. *nuda*, "The naked smut." The other kind, which is less abundant in Denmark, does not destroy the outer case of the kernels; this remains intact for some time, but eventually a certain proportion of the spores escape through numerous minute fissures which appear in it = var. *tecta*, "The covered smut." The affected ears are, moreover, at first nearly twice as broad as the healthy ears are, and do not, like them, emerge at the top of the sheath but through its sides.

In 1886 I examined a great number of specimens of these two varieties and satisfied myself of their distinction. Subsequently, however, I had sent to me a few plants affected with both kinds (*nuda* and *tecta*), which led me to re-investigate the subject this year. In the experiment quoted above with barley smut, the variety *tecta* only was used for infecting the bare kernels. The result was, that out of the 78 smutted ears thereby produced, two only, and these were produced on the same plant, were of the variety *nuda*. In the control plot, however, sown with barley which had not been artificially infected, a single smutted plant was produced, and this was also of the variety *nuda*. We may conclude therefore that these two plants affected with *nuda* arose from a natural infection of the seed corn. Both kinds may usually be found in the same field, but *nuda* as a rule most abundantly. In those rare cases in which both varieties occur on the same plant, the explanation is simply that it has been naturally infected with the spores of both varieties.

With regard to the variety of smut which occurs on wheat, it should be remarked that only one diseased plant was produced in the infection experiment quoted above. Now the germinative power of wheat-smut spores is much more feeble than of the other varieties. I found that of last year's wheat-smut spores only one or two in a thousand germinated when examined this year, although they had been kept in a dry place all the winter. Further, wheat-smut spores produced this year (1888) germinated even more feebly, while with barley-smut and oat-smut spores

the germinative faculty was more than a hundred times as great. This accords with the well-known fact that wheat is less liable to be smutted than other kinds of corn. All this tends to show the distinctness of wheat smut from the other varieties.

Further researches are desirable before we pronounce these different kinds of smut to be true species. For the present it is safer to regard them as varieties, which may be thus designated:

Wheat smut, *Ustilago segetum*, var. *tritici.*

Oat smut, *Ustilago segetum*, var. *avenæ.*

Naked barley smut, *Ustilago segetum*, var. *hordei nuda.*

Covered barley smut, *Ustilago segetum*, var. *hordei tecta.*

I would also add that some smutted ears of oats differ very considerably in their appearance from others, but I have not had the opportunity of investigating this question minutely.

3. Now, as it has been shown that infection is due to spores included within the husk, we cannot regard it as impossible that plants may now and again, in very rare instances, be infected from spores adhering externally to the husk in cases where a spore or two may chance to be very favourably placed.

4. As the husk of barley is closely adherent to the grain on all sides, it is impossible to wash out the spores when once they have gained an entrance, while with oats it may be possible to a very limited extent to do this. On the other hand, by dipping oats into water charged with spores, it is quite possible, as the above experiment shows, that some of them may be carried through the fissure in the husk to the kernel; but this is impossible with barley. It is possible that in the process of thrashing some of the husk of oats may become detached—and even to a lesser extent may this happen to barley; and when such grains are sown with spores adhering externally they may produce diseased plants. This may be the explanation of those experiments in which some persons have asserted that they have produced smutted plants by dusting the seed-corn with spores—although it is most probable that the experimenter unconsciously employed grain already containing spores inside its husk from natural infection.

C.—Prevention of Smut.

Various dressings have been recommended as preventives against smut in barley and oats, amongst which are (1) sulphate of copper in solution alone, (2) solution of sulphate of copper with quicklime applied about twelve hours afterwards, (3) sulphuric acid and water, (4) quicklime with or without subsequent treatment with common salt.

During the year 1887 I conducted a series of experiments with these dressings, the results of which are appended in a tabular form.

RESULTS OF DISINFECTION EXPERIMENTS WITH OATS.

No.	Means of Disinfection	Per cent. of smutted ears in the crop	Germinating power of spores in seed per cent.	Estimation of quality of crop at the beginning of July. Scale 1 to 5
1	Undressed	36	20	5. Very good
2	$\frac{1}{4}$ p.c. sulphate of copper .	$\frac{1}{2}$	5	4. Good
3	1 p.c. sulphate of copper .	0	0	1. Very bad
4	1 p.c. sulphate of copper with 4 p.c. quicklime . .	$\frac{1}{2}$	?	$4\frac{1}{2}$ Good, almost as good as No. 1
5	$\frac{3}{4}$ p.c. English sulphuric acid	13	1 or 2	4. Good
6	1 p.c. English sulphuric acid	2	?	3. Moderate
7	$1\frac{1}{4}$ p.c. English sulphuric acid	$\frac{1}{4}$	?	3. Moderate
8	$1\frac{1}{2}$ p.c. English sulphuric acid	0	0	2. Bad
9	4 p.c. quicklime and 2 p.c. salt	9	4	4. Good
10	Dry heat. 122° F. for 7 hours	36	20	$4\frac{1}{2}$. Good, almost as good as No. 1.
11	Dry heat. 129° F. for 7 hours	34	?	$4\frac{1}{2}$. Good, almost as good as No. 1.
12	Moist heat. 127° F. for 5 hours	0	0	3. Moderate
13	Warm water. 127° F. for 5 minutes	$\frac{1}{2}$	$\frac{1}{2}$	5. Very good
14	Warm water. 133° F. for 5 minutes	0	0	5. Very good

Having found that the spores of smut lose their germinating power when they are placed for two or three minutes in water at a temperature of from 127° to 137° F., and that the seed-corn was uninjured by the treatment, I was led to think that this method would be a good and convenient one for preventing smut in these plants; preferable to the disinfection of the seed-corn by the chemical agents enumerated above, all of which have some drawbacks. I also tried a number of experiments with moist and dry heat, although these methods were obviously less adapted for practical use even if they proved efficacious. The seed-oats employed in these experiments were taken from a field badly affected with smut, while the barley-seed was from a field in which three per cent. of the ears were diseased.

Hundreds of spores adhered externally to the oats, the germinating power of which was tested before they were planted.

The chemical disinfectants in the first nine experiments were mixed in the stated proportions with water. It will be observed that No. 10, in which the germinating power of spores was not diminished, gave as many blighted ears as the undisinfected sample No. 1; also that the complete destruction of the vitality of the spores in experiments 3, 8, 12, 14 was followed by a crop without a smutted ear, and that a considerable reduction in the vitality of the spores was accompanied by a considerable reduction in the proportion of the smutted ears in the crop (Nos. 2, 5, 9, 13).

In one of the experiments, however (No. 2), the reduction of the smutted ears in the crop was considerably greater (from 36 to ½ per cent.) than would have been anticipated from the moderate reduction in the vitality of the spores (from 20 to 5 per cent.). Provided the disease in the crop does not arise from a mycelium in the seed, which is, I think, almost out of the question, this discrepancy may be accounted for by the fact that the sulphate of copper, which was the agent employed, not only kills a part of the spores, but poisons a certain proportion of the remainder. In this the action of sulphate of copper differs from the other substances employed. Many of the seeds germinated incompletely by emitting the embryo only, so that the young plants remained for two or three weeks rootless in the ground. It is possible that in Experiment 2 the sulphate of copper had only killed three-fourths of the spores, yet the other fourth was so enfeebled by its action that the spores were incapable of sending a mycelium into the young plant.

Respecting the action of the above methods of dressing the seed-corn the following remarks suggest themselves:—

Sulphate of Copper.—A watery solution containing only a ¼ per cent. of this salt reduced the number of smutted ears to such an extent (1 : 72) that it might be considered practically sufficient. But part of the seed-corn was killed, and the crop suffered not inconsiderably. With a one per cent. solution about three-fourths of the seed-corn was killed, and a large number of the young plants remained without rootlets for two or three weeks. This lot was still green when all the others were almost ripe.

Sulphate of Copper and Lime.—The effect of a one per cent. solution of sulphate of copper, followed twelve hours afterwards with lime, was very remarkable. The addition of lime saved a considerable portion of the seed from destruction, though not all, so that the crop was almost as good as that from No. 1 (the

undressed sample). It will be seen from the table, however, that, to a certain extent, it preserved the spores from injury, as there were a number of smutted ears in the crop.

Sulphuric Acid.—It was found that when the acid was employed of sufficient strength to kill the spores, it killed a considerable quantity of the seed-corn as well.

Lime and Common Salt reduced the smut to one fourth; but this is not sufficient; moreover, the crop was injured in no small degree. Probably this was due to the action of the salt. The lime was applied in a state of powder in the proportion of half a bushel to a quarter of oats.

The experiments with the chemical agents above mentioned were made by pouring the solution on the corn in saucers to such an extent that rather more solution was used than the grain could absorb in twelve hours; the grain was frequently turned, so as to ensure all parts of it being brought into contact with the solution.

Disinfection by Heat.—Dry heat for seven hours did not diminish the blight, but heating in moist air for five hours completely killed the spores, but also injured the seed-corn. Heating the seed-corn in water for only five minutes at 133° F. entirely protected the crops from smut and did not injure the oats at all. Immersing the seed in water at 127° F. for five minutes reduced the blight to such an extent (1 : 72) as to be sufficient for all practical purposes. But more than this, the same simple treatment is sufficient for the protection of wheat from bunt (*T. tritici*); and from my experiments with barley and rye it is evident that they can be by the same simple treatment protected from their respective smuts.

These 1887 experiments with oat-smut were so conclusive that further evidence of the disinfecting power of water at a temperature of 127° to 133° F. is almost unnecessary. I will therefore only give the results of two experiments made on a large scale by Mr. C. F. Jensen on the Rodstenseje farm during the present year (1888). Five bushels were dipped in water at 127° F. and one bushel in water at 133° F. for five minutes each. Subjoined is the result:—

Oats unprotected, out of 4,000 plants	294 were smutted.
Oats dipped for 5 min. in water at 127° Fahr.; the whole crop	0 „ „
Oats dipped for 5 min. in water at 133° Fahr.; the whole crop	0 „ „

Not a single smutted ear could be found in these comparatively large plots of protected oats.

Experiments with Barley.

Similar experiments were conducted with barley, but some of the results differed from those obtained from oats in an unexpected manner. Sulphate of copper and sulphuric acid, it has been asserted, are very effectual dressings for barley; but I find that their action as such is hardly appreciable if we keep within the limits usually recommended for not damaging the seed-corn.

Undressed barley	in 1,000 ears	16	were smutted.
1½ per cent. sulphuric acid . . .	„ „ „	13	„
1 per cent. sulphate of copper . . .	„ „ „	13	„

These remarkable results were corroborated by similar experiments conducted by my friends under my direction at Rodstenseje and Gersdorfslund. Their experiments are the more interesting as the quantity of sulphuric acid was nearly double in one series, while in the other no less than a 5 per cent. copper solution was employed.

RODSTENSEJE.

Undressed barley	amongst	2,000	ears	49	were smutted.
1 per cent. sulphate of copper .	„	2,000	„	38	„
„ quicklime 12 hours after	„	2,000	„	50	„
2·7 per cent. sulphuric acid . .	„	2,000	„	43	„
„ quicklime 12 hours after	„	2,000	„	41	„

GERSDORFSLUND.

Undressed barley	amongst	2,000	ears	40	were smutted.
1¼ per cent. sulphate of copper .	„	2,000	„	58	„
5 per cent. „ „ .	„	2,000	„	13	„

In the first series the seed was completely immersed in the solution for twelve hours. The figures speak for themselves. The sulphuric acid of this strength killed a great deal of the corn, but was of little value in preventing the smut; and the same is true of the 5 per cent. sulphate of copper, which, although it killed much of the corn, did not completely prevent smut.

Lime and Salt did not appreciably diminish the blight.

Heating.—A quantity of the seed-barley heated for five hours to 127° F. did not produce a single smutted ear, and the vitality of the seed was not materially damaged, while a similar quantity of oats so treated lost half its germinative faculty. The samples were moistened, put into two bottles, and heated in a water bath. Possibly this difference may have arisen from the barley not having been quite so much wetted as the oats; at any rate, subsequent experiments showed that, like oats, barley soon loses its vitality if heated too long or too much. Dry-heating did not diminish the smut. Heating in water to 127° F. and 133° F. for five minutes was also without effect.

The question presents itself, why do sulphuric acid, sulphate of copper, and warm water, as previously described, kill the smut in oats and not in barley, although all the spores adhering externally were proved to be killed? I think it is because the barley is closely and completely invested by its husk, while the oats are not; so that the disinfecting solution can freely enter the space between the husk and the kernel and act on the spores in the latter, and not in the former. With barley the disinfecting solution cannot arrive at the kernel without soaking through its outer coating, and in so doing, as chemists tell us, a solution of sulphate of copper would by osmosis be materially reduced in strength by the time it reached the kernel. Thus it is that the germinative power of barley is apparently not injured by comparatively strong copper solutions. In like manner the reason that dipping barley for five minutes in warm water is without effect on the smut is because the water had not time to soak through and get to the kernel, and, therefore, the included spores were only subjected to a dry heat, which, as we have seen, is comparatively easily withstood by the spores. If we suppose the barley kernel to be pervaded by a mycelium the same explanation obtains. It seemed probable that by first soaking the barley for a longer period, such as half a day or a day, and then dipping it into heated water, complete disinfection could be obtained. This has been confirmed in the most satisfactory manner by Mr. C. F. Jensen of Rodstenseje, who this year (1888) at my suggestion treated all his seed-barley (about 200 bushels) by steeping it in cold water for half a day and then dipping it for five minutes in water heated to 127° F., with the following result:—

2,000 unprotected barley plants had 45 smutted.
2,000 treated with warm water as above, none smutted.

In fact, in the whole field of protected barley only a single smutted plant was found. The germinative power of the barley was unimpaired; it is now (August 6) growing luxuriantly and promises to produce a heavy crop. It must be observed that steeped barley will not stand more than 127° F. without injury, but when only sprinkled with water 133° F. for five minutes will not injure it. This last proceeding, however, does not appear to be so efficacious.

Is it necessary to repeat the protective dressing for smut every year? Probably not, because smut propagates itself comparatively slowly. The rate of increase in the different varieties of oats grown on the experimental farm at Copenhagen cannot be taken as a guide on this point, because these varieties were grown in

adjacent plots, whereas in actual practice the oatfields would be scattered about the farm. So long as the amount of smut does not exceed $\frac{1}{4}$ per cent. it is hardly necessary to dress the seed. It must, however, be remembered that some varieties are more susceptible to smut than others.

Practical Application of Heat to the Seed-corn.

We have seen that smut can be prevented in oats and barley by dipping the seed in heated water without injuring its vitality. This is easily practicable in the following manner. The grain to be dipped is placed in a shallow cylindrical basket about twelve inches deep lined with coarse canvas, and provided with a cover made by stretching the canvas over a ring of such a diameter as will pass inside the mouth of the basket. The canvas should overlap the ring by about an inch all round. An ordinary boiler, such as is found on every farm, is filled with water and heated to boiling point.

Two vessels of sufficient size are placed near it. These may be designated 1 and 2. Supposing the boiler to contain 35 gallons of boiling water, if $12\frac{1}{2}$ gallons of cold and the same quantity of boiling water be put into each vessel, we shall have 25 gallons of water at 132° F. in both of them. The exact temperature may be readily obtained by adding a little more hot or cold water, as the thermometer shows to be required.

A basket containing three quarters of a bushel of corn, which must not be more than eight inches in depth, is now dipped into No. 1 four times; this will take rather more than half a minute, and will reduce the temperature of the water eight or nine degrees. It is now to be rapidly dipped five or six times into No. 2, which will take about one minute, and then dipped once per minute for three minutes longer, *i.e.* five minutes altogether in the two vessels. This will reduce the temperature of the water in No. 2 from 132° to 129°–130°. If steeped barley be used the original temperature of No. 1 should be 129°–130°; but with unsteeped grain, for oats, barley, or rye, it does not matter if the original temperature be 133°–136°.

The seed-corn must now be cooled. This is best done by placing the basket on the top of a third vessel and pouring a couple of buckets of cold water upon the corn in it, taking care that the cold water falls not only upon the centre, but round the edges, so that the corn may be uniformly cooled. The basket is now emptied on the floor, and the corn spread out in a thin layer, so that it may cool completely. The water used in cooling the corn will have its temperature raised and may be

employed in replenishing the boiler. The requisite temperature (132° F.) of vessels Nos. 1 and 2 must be maintained throughout the process by adding from time to time boiling water from the boiler and transferring from them a similar amount back again to the boiler. The temperature must be regulated by a thermometer, which when used must be plunged deeply into the water.

The basket must be completely immersed each time, then lifted quite out of the water so as to allow it to drain for four or five seconds before it is dipped again.

The above process in practice will be found simple and easy enough to perform, although its description is necessarily somewhat complicated.

D. Prevention of Bunt.

With bunt, so much more virulent is the power of infection, that annual dressing of the seed-corn is necessary, and this appears to be the custom amongst farmers of all nations. I have made a number of experiments with bunt as well as with the smut of rye (*Urocystis occulta*). These are now so far complete as to enable me to affirm that dipping the seed-corn in water of 127° F. for five minutes will effectually prevent both these diseases. No previous steeping of the corn being necessary, there is no danger in employing as high a temperature as 133° F. This, however, is the maximum limit and it is advisable to keep a little below it. I have conducted a series of experiments in which the results obtained by disinfection by heated water, and by sulphate of copper (the ordinary method), were contrasted. The following is an epitome of the results:—

(*a.*) Sulphate of copper in the quantities generally employed will destroy not only the fungus, but from three to ten per cent. or even more of the seed-corn. Disinfection by heated water does not injure the seed-corn to any appreciable degree.

(*b.*) Sulphate of copper impairs the vitality of the young plants even when it does not kill them; so that their average weight in autumn is distinctly less than that of those disinfected by warm water. This injury to the young plants is of far greater importance than the mere killing of a certain proportion of the seed-corn.

(*c.*) The first-named plants are therefore less able to withstand the winter than the latter. Not only do a greater number die during the winter, but those which survive are less vigorous, and in summer have a smaller average weight. It is obvious, therefore, that as a general rule the crop produced

from seed dressed with sulphate of copper will be essentially diminished thereby. Especially so will this be the case after such a severe winter as 1887–8 was in Denmark; for I found in my experiments this year (1888) with wheat that the yield of the corn averaged 30 per cent. more on those plots sown with heat-disinfected seed than on those sown with seed-corn dressed in the usual way with sulphate of copper. The yield of straw too was 23 per cent. in favour of the heat-disinfected seed.

It may be remarked that the above results were obtained from corn thrashed in the usual way (by a machine), but I found that when the grains were picked out of the ears by hand it suffered much less from the treatment with sulphate of copper.

Conclusion.

Dressing cereals with sulphate of copper in the usual manner against smut and bunt causes as a rule a waste of the seed-corn. It is injurious to the plants and unnecessary. Treating the seed-corn with water heated to a temperature of 127° F. for five minutes prevents these diseases equally well, and protects barley much better, while it has the advantage of not injuring the seed-corn or the resulting crop.

XXII.—*The Herbage of Old Grass Lands.* By W. Fream,

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The grass lands of England constitute so large a proportion of her agricultural wealth as to justify, and even to demand, the most careful observation and study to which pastures and meadows can be subjected. Within recent years one branch of the subject, that of laying land down to grass, has been very fully discussed, and much valuable experience has incidentally been placed on record. But although considerable information has been forthcoming concerning the most approved methods of forming new grass lands, it can hardly be said that our knowledge of the constitution, and more particularly of the herbage, of old grass lands has made much progress.

Yet, from an economic point of view, the old meadows and pastures of this country are far more important and far more valuable than those of recent creation, whilst many of them are so famed for their general excellence of character that they may fairly be taken to constitute the ideal in the direction of which

it should be the object of the cultivator to improve the inferior grass lands. To create a good meadow or pasture is a legitimate triumph of agricultural skill, and the more nearly such new grass land can be made to resemble the best old grass lands of the country the more complete the triumph becomes. That the herbage growing upon a meadow or a pasture is one of the most essential factors of its feeding capacity is a proposition that needs no support, and the chief object of this paper is to inquire into what may be termed the botanical composition of some of our best meadows and grazing lands.

The subject had attracted attention in this country more than a century ago. In Kent's "Hints to Gentlemen of Landed Property" (2nd Edition, 1776) we read—

"Meadow and pasture land is oftener neglected than ploughed ground, notwithstanding it generally admits of a much greater proportion of improvement. The best grasses cannot be collected at too great an expense; for I have seen a small spot of land, in the middle of a large piece which was laid down twelve or fourteen years since by Mr. Stillingfleet, upon the estate of Mr. Price, of Foxley, in Herefordshire, with some choice seeds, at the same time when the remainder of the field was laid down with common seeds; and this spot is considerably better than the rest. It not only appeared so to my judgment, but was allowed to be so by Mr. Price's bailiff, who was well acquainted with its produce."

At the end of the last, and beginning of the present century, William Curtis—referred to by George Sinclair in his "Hortus Gramineus Woburnensis" as "the late excellent Mr. Curtis" —was probably the leading authority on the subject in this country. In 1790 he published a work entitled "Practical Observations on the British Grasses, especially such as are best adapted to the laying down or improving of meadows and pastures: likewise an enumeration of the British Grasses." In 1812 the fifth edition, "with additions by John Lawrence, author of the 'New Farmers' Calendar,'" was issued, so that in all probability the work enjoyed considerable popularity. In order to determine the specific nature of the natural herbage growing in certain situations Curtis procured from each of the under-mentioned commons in Hampshire and Sussex a turf, about six inches in diameter, and planted it in his garden. A turf from Selborne Common yielded, of grasses, Agrostis vulgaris, Avena flavescens, Dactylis glomerata, Festuca duriuscula, Poa annua, and Cynosurus cristatus; of leguminous plants, Trifolium repens; and of miscellaneous weeds, Plantago lanceolata, Crepis tectorum, Achillea Millefolium, Galium verum, Hypochæris radicata, Hieracium Pilosella, and Thymus Serpyllum. A turf from Oakhanger produced, of grasses, Holcus lanatus, Poa annua, Agrostis vulgaris; and of clovers, Trifolium repens. A turf

from Deortun gave, of grasses, Lolium perenne, Holcus lanatus, Festuca duriuscula, Agrostis alba; of clovers, Trifolium repens; and of weeds, Ranunculus repens, Prunella vulgaris, Crepis tectorum, and Achillea Millefolium. Two turfs from Glynd Hill yielded, the one, Poa pratensis, Medicago lupulina, and Achillea Millefolium; the other, Avena flavescens, Festuca ovina, Festuca duriuscula, Agrostis vulgaris, Trifolium repens, Hieracium Pilosella, and Thymus Serpyllum. A turf from Short Heath afforded Aira præcox, Festuca bromoides, Poa annua, Agrostis vulgaris, and the rush, Juncus campestris. A turf from Mount Cabron produced Avena flavescens, Festuca duriuscula, Medicago lupulina, and three weeds—Rumex Acetosa, Daucus Carota, and Poterium Sanguisorba. A turf from Ringmer Down yielded, of grasses, Avena flavescens, Festuca duriuscula, Festuca ovina, and Poa pratensis; of leguminous plants, Trifolium repens, Ornithopus perpusillus, and Lotus corniculatus; and of weeds, Linum catharticum, Scabiosa Columbaria, Hypochæris radicata, Crepis tectorum, Juncus campestris, Hieracium Pilosella, and Thymus Serpyllum.

These eight turfs were all taken from sheep-fed land, and the following statement shows the number of turfs each species of grass and leguminous plant occurred upon:—*Grasses.*—Festuca duriuscula 5, Agrostis vulgaris 4, Avena flavescens 4, Poa annua 3, Poa pratensis 2, Festuca ovina 2, Holcus lanatus 2, Agrostis alba 1, Dactylis glomerata 1, Cynosurus cristatus 1, Lolium perenne 1, Aira præcox 1, and Festuca sciuroides 1; there being in all 12 species of grasses detected.

Leguminous Plants.—Trifolium repens 5, Medicago lupulina 2, Ornithopus perpusillus 1, and Lotus Corniculatus 1.

These results may probably be relied upon as showing the botanical composition of native down sheep pastures a century ago. As is well known, the short, sweet natural herbage of these downs differs much from the richer, greener, and more succulent vegetation met with in prime old pastures and meadows. Since Curtis's time, and since that of Sinclair, very little exact observation seems to have been directed to the botanical composition of our grass lands, though within recent years Sir John Lawes has had several pastures submitted to botanical analysis.

It will probably prove convenient, and save the reader trouble, if I at once enumerate the plants to which I shall have occasion to refer in the following pages. Accordingly, in the subjoined lists will be found the names of the gramineous, leguminous, and miscellaneous species of which mention will be made, and for facilitating reference they are arranged in alphabetical order and not in botanical order. Any one who has had occasion to read French,

German, or American writings upon agricultural botany will be familiar with the confusion and uncertainty which arise from a careless style of nomenclature, a fault from which many of our English writings are not free. Hence, in these reference tables I have given the systematic name of each plant, and the authority for that name —" L.," Linnæus; " Huds.," Hudson; and so on —a system which is invariably adopted in scientific writings. Moreover, as the common names are much confused, not only between different countries, but between different parts of the same country, I shall throughout employ the systematic name, as this is good currency in all civilised countries. By referring to the following tables the reader may see at a glance what is the common name of any plant mentioned in the subsequent pages:—

Gramineous Species, or Grasses.

Agrostis alba, L.	Marsh bent grass
Agrostis alba var. stolonifera, L.	Fiorin
Agrostis vulgaris, With.	Fine bent grass
Aira cæspitosa, L.	Tufted hair grass
Alopecurus geniculatus, L.	Floating foxtail
Alopecurus pratensis, L.	Meadow foxtail
Anthoxanthum odoratum, L.	Sweet-scented vernal grass
Avena elatior, L., or Arrhenatherum avenaceum, Beauv.	False oat grass
Avena flavescens, L.	Yellow oat grass
Avena pubescens, Huds.	Downy oat grass
Briza media, L.	Quaking grass
Bromus mollis, L.	Soft brome grass
Bromus racemosus, L.	Smooth brome grass
Cynosurus cristatus, L.	Dogstail
Dactylis glomerata, L.	Rough cocksfoot
Festuca elatior, L.	Tall fescue
Festuca pratensis, auct	Meadow fescue
Festuca ovina, L.	Sheep's fescue
Festuca duriuscula, L.	Hard fescue
Festuca rubra, L.	Creeping fescue, red fescue
Glyceria aquatica, Sm.	Reed sweet grass
Glyceria fluitans, R. Br.	Floating sweet grass
Holcus lanatus, L.	Yorkshire fog, woolly soft grass
Hordeum pratense, Huds.	Meadow barley grass
Lolium perenne, L.	Ryegrass
Phalaris arundinacea, L.	Reed canary grass
Phleum pratense, L.	Timothy, or meadow catstail
Phragmites communis, Trin.	Great reed
Poa annua, L.	Annual meadow grass
Poa pratensis, L.	Smooth-stalked meadow grass
Poa trivialis, L.	Rough-stalked meadow grass

Leguminous Species.

Lathyrus pratensis, L.	Meadow vetchling
Lotus corniculatus, L.	Common birdsfoot trefoil
Lotus major, Scop.	Narrow-leaved birdsfoot trefoil

Medicago lupulina, L. . . .	Yellow trefoil, "hop," "trefoil," black medick
Trifolium minus, Sm. . . .	Yellow suckling clover
Trifolium pratense, L. . . .	Purple or meadow clover
Trifolium repens, L.	White or Dutch clover
Vicia Cracca, L.	Tufted vetch

Miscellaneous Species.

Achillea Millefolium, L. . . .	Yarrow or milfoil
Bellis perennis, L.	Daisy
Bunium flexuosum, With. . . .	Earth-nut or pig-nut
Centaurea nigra, L.	Black knapweed
Cerastium triviale, Link. . . .	Narrow-leaved mouse-ear chick-weed
Heracleum Sphondylium, L. . .	Cow-parsnip
Leontodon autumnalis, L. . .	Autumnal hawkbit
Leontodon hispidus, L. . . .	Rough hawkbit
Plantago lanceolata, L. . . .	Ribgrass, ribwort, or plantain
Potentilla Anserina, L. . . .	Silver-weed or goose-tongue
Prunella vulgaris, L.	Selfheal
Ranunculus acris, L.	Upright buttercup
Ranunculus bulbosus, L. . . .	Bulbous crowfoot or buttercup
Ranunculus repens, L. . . .	Creeping crowfoot or buttercup
Rumex Acetosa, L.	Common sorrel or sour dock
Rumex crispus, L.	Curled dock
Taraxacum officinale, Web. . .	Dandelion
Veronica Chamædrys, L. . . .	Germander speedwell

The water meadows of the southern and western counties of England afford a convenient means of studying the effects of a long-continued uniformity of conditions upon meadow herbage, though but little advantage appears to have been taken of the opportunity thus offered. Marshall, in his "Rural Economy of the Southern Counties," published in 1798, describes the water meadows around Salisbury, and gives the following extract from his note-book under date of July 5, 1791:—

"The herbage of the watered beds is various in species, as ray-grass, the meadow poe, the marsh and other bent grasses, and the meadow fescues; the *loliacea* and the *pratensis*, here putting on very different appearances. On the sides of the trenches, and ditches, the flote fescue, reed canary grass (Phalaris arundinacea) and the water poe (Poa aquatica) are common, also the meadow rue (Thalictrum flavum) and the water dock. . . . . At what an excessive cost must these lands have been brought into their present state! When, and in what manner, was so great and spirited a public work executed?"

In the subjoined list are enumerated all the grasses I have been able to find growing upon about fifty acres of water meadows situated in the valley of the Christchurch Avon in Hampshire, my observations having extended over several years. I found on these irrigated grass lands the following twenty-six species of grasses, and no more:—

1. Agrostis alba.
2. *Agrostis vulgaris.*
3. Aira cæspitosa.
4. Alopecurus geniculatus.
5. *Alopecurus pratensis.*
6. *Anthoxanthum odoratum.*
7. *Avena elatior.*
8. *Avena flavescens.*
9. *Briza media.*
10. *Bromus mollis.*
11. Bromus racemosus.
12. *Cynosurus cristatus.*
13. Festuca duriuscula.
14. Festuca elatior.
15. Festuca loliacea.
16. *Festuca pratensis.*
17. Glyceria aquatica.
18. Glyceria fluitans.
19. *Holcus lanatus.*
20. *Lolium perenne.*
21. Phalaris arundinacea.
22. Phleum pratense.
23. Phragmites communis.
24. Poa annua.
25. *Poa pratensis.*
26. *Poa trivialis.*

Of these, Holcus lanatus is first in point of quantity, the second place in this respect belonging to either Bromus mollis or Lolium perenne. It is a noteworthy circumstance that Dactylis glomerata does not occur upon these water meadows. Instituting a comparison between the grasses of the water meadows and the species which have been detected upon the very old non-irrigated grass land in Rothamsted Park (" Phil. Trans.," Part IV., 1882), it appears that thirteen species are found in both situations, and these are printed in italics in the foregoing list. Furthermore, Aira cæspitosa and Phleum pratense occur sometimes upon some of the experimental grass plots in Rothamsted Park, whilst two other species, Festuca elatior and Festuca loliacea, though they have occasionally been found at Rothamsted, are extremely rare there. Three very common species at Rothamsted, Avena pubescens, Dactylis glomerata, and Festuca ovina, do not occur upon the water meadows.

The herbage found growing upon these water meadows comprises twenty-six gramineous species, seven leguminous species, and fifty-three miscellaneous species. The leguminous plants are:—

1. Lathyrus pratensis.
2. Lotus corniculatus.
3. Lotus major.
4. Medicago lupulina.
5. Trifolium pratense.
6. Trifolium repens.
7. Vicia Cracca.

Of these, all excepting Medicago have been found in Rothamsted Park, under one or other of twenty different conditions of manuring.

Numerous attempts have been made, with varying degrees of success, to lay land down to permanent pasture. Any one would probably feel well satisfied with his endeavours should he at length arrive at a result comparable with the rich old pastures of England and Ireland. A desirable means to this end would obviously be some exact knowledge as to the nature of the herbage growing upon these old grass lands. In the case of

meadows which come annually under the scythe, such knowledge is not difficult to acquire; but in the case of many of the best pastures, which are continuously grazed but never mown, many obstacles present themselves. A pasture may possess excellent fattening properties, or it may be famous for the rich and copious flow of milk it promotes; but from the very fact that it is always grazed, an exact knowledge of the botanical composition of its herbage may remain a sealed book even to those who see the pasture daily. Certainly it would be possible to fence in a small portion of a pasture, and so allow the enclosed area to declare the specific character of the plants growing upon it; but it would be difficult and expensive for one observer to keep a number of these under constant inspection in different parts of the country. There is one other practicable method, and that is to collect typical specimens of the turf from a number of the best grass lands, and grow them all side by side in one place, so that they can be subjected to continuous inspection and examination. This is the system I have followed in the experiments now to be described.

As it might be objected that paring off a turf and transporting it to another soil might influence the development of the herbage, favouring the growth of some species and hindering that of others, I arranged that, notwithstanding its removal, each turf should continue to grow upon its own soil. Thus, my request to those gentlemen who have so kindly aided me was that each turf should be cut 2 feet long, 1 foot broad, and 9 inches deep, and in the majority of cases these dimensions have been adhered to. The superficial area of each turf is thus about nine times that of the turf upon which Curtis made his observations at the end of last century, whilst the depth of 9 inches is quite sufficient for, at any rate, one season's growth.

In the Botanical Garden, at the College of Agriculture, Downton, I set apart a bare fallow bed, 72 feet long by 6 feet broad, and, as the turfs came to hand, holes were dug in the bed and each turf was planted so as to bring the herbage to the level of the general surface; the turfs were planted symmetrically along the middle of the bed, and between each turf there was left a bare space somewhat exceeding the width of the turf. The first turf was planted on November 29, 1887, and is called No. 1, the others receiving consecutive numbers in the order in which they were planted. The bed was kept free from weeds throughout the season, but the turfs received no attention whatever—they were simply allowed to grow, and were periodically inspected, every species on each turf being noted as soon as it became recognisable, a record also being kept in my note-book

of the general appearance of each plot. It was specially desired that each turf should be cut from, and should be typical of, what practical men regard as *the best* grass-land of each district. In no case did I select the turf myself, preferring always to be guided by those whom long experience had taught where to select the best old herbage in their respective districts.

In all, 25 turfs were received and planted, 17 from England and 8 from Ireland. The English specimens comprised 3 from Somerset, 2 each from Dorset, Wilts, and Kent, and 1 each from Lincolnshire, Leicestershire, Derbyshire, Staffordshire, Buckinghamshire, Gloucestershire, Herefordshire, and Devonshire. The Irish specimens were 1 each from the counties of Tipperary, Kildare, Mayo, Meath, Cork, Wexford, Dublin, and Clare. With one or two exceptions, which are noted, all these turfs were taken from old pastures and not from meadows.

In the month of July the herbage upon each turf was cut, but they were not all cut simultaneously, for a reason which will at once be made apparent. Directly a turf was mown the herbage was, without loss of time, separated into what I may call its proximate botanical constituents of gramineous herbage, leguminous herbage, and miscellaneous herbage, and each section was at once divided into its specific elements. This work is of a tedious and laborious character, particularly the separation of the gramineous herbage into its component grasses; but it is the method which has been followed in the Rothamsted experiments, and no better system is available. As soon as the botanical analysis or separation was completed the various sections were weighed on a balance, with metric weights, and the results recorded. The separation was performed in the shade, and the green weights were taken, as it is in the green state that the herbage of pastures is consumed.

My note-book records (1) the general appearance of each plot from time to time, (2) a note of every species of plant observed growing upon each plot, (3) the total weight in grams of the cut herbage from each turf, (4) the actual weight—when it exceeds one gram—of each species of plant found in the herbage of each plot, (5) the calculated percentage by weight of each species when present in a significant proportion.

It is impossible to burden this paper with all these details. Accordingly, in the following brief summary of the results afforded by each turf, what has been attempted is to give (*a*) a short account of the origin and history of each specimen, (*b*) the respective percentages by weight of its gramineous, leguminous, and miscellaneous herbage, (*c*) the proportionate weight per cent. in which the various species of grasses are contained in the

gramineous herbage, and (*d*) a few notes on the leguminous and the miscellaneous herbage. Then follows a summary table, into which much information has been condensed; but this will be referred to in its proper place.

It is necessary at this stage to direct attention to two points concerning the nomenclature adopted in the following descriptions. In the first place, it will be found that the expression "Agrostis sp." is used, meaning that the plant is a species of Agrostis, though the particular species is not expressed. In the reference table of species already given there occur Agrostis alba, Agrostis alba variety stolonifera, and Agrostis vulgaris. Botanists, however, are not entirely agreed as to these being separate species. Bentham, who was probably the greatest systematist of this century, regards all three as the same species, and he remarks ("The British Flora," 1878):—

> "Besides the great differences in size and stature, it varies in the more or less spreading panicle of a light green or purplish colour, in the length of the ligula of the leaves, in the degree of prominence of the nerves of the glumes and the roughness of their keel, and in other minute particulars; but all attempts to combine these characters so as to show distinct species, or even to separate marked or permanent varieties, have hitherto failed."

Accordingly, I have not attempted the well-nigh impossible task of separating Agrostis into its varieties, though the form known as Agrostis stolonifera was as unmistakably present upon some of the plots—the Staffordshire turf (No. 6) for example—as the form usually regarded as Agrostis vulgaris was present on others.

The second point concerns sheep's fescue and its varieties, which I have estimated together under the designation "Festuca ovina et var." Two types of fescue grass are known to agriculturists, the broad-leaved forms, of which Festuca pratensis may be taken as the type, and Festuca loliacea and Festuca elatior probably as extreme modifications, and the narrow-leaved forms, represented typically by Festuca ovina. Both Bentham and Hooker, and even Babington to some extent, regard Festuca duriuscula and Festuca rubra as mere sub-species or varieties of Festuca ovina, and accordingly "Festuca ovina et var." may mean any or all of these three. The labour of separating the grasses was severe, and it would have been mere waste of time to have attempted to distinguish between the several forms of Agrostis and of the fine-leaved Festucas; indeed, as in many cases there were only leaves, or fragments of leaves, it would have been impossible. Bearing this reservation in mind, we may pass on to the examination of the series of turfs.

No. 1.—A turf sent by Mr. James Martin, of Wainfleet,

Lincolnshire. It was cut from one of the best cattle-feeding pastures of the district—Mr. Epton's, of Northolme—and the sample presented the appearance of a rich brown friable loam. Mr. C. H. Hooper writes that the pasture from which the sample was taken is three miles from the Wash, lying upon an alluvial soil, between marsh and fen. The land becomes mossy in places, and is occasionally undulating, but mostly flat. This plot was cut on July 16, and a botanical analysis of the herbage gave the following percentage results:—

Gramineous herbage	75	100
Leguminous herbage	11	
Miscellaneous herbage	14	

The gramineous herbage was thus made up:—

Lolium perenne	67	100
Dactylis glomerata	20	
Bromus mollis	4	
Holcus lanatus, Cynosurus cristatus, Agrostis sp.	8	
Avena flavescens, Poa trivialis, Festuca ovina	1	

The leguminous herbage was all Trifolium repens, whilst three-fourths of the weeds consisted of Cerastium triviale, the remainder being chiefly Rumex Acetosa.

No. 2.—A turf sent by Mr. George Button, of Tenterden, Kent. The land from which it was taken is situated in the parish of Tenterden, and the sample had the appearance of a stiff plastic moist clay, of a yellowish-brown or ferruginous colour. It is probably marine alluvium, and the pasture possesses good feeding, though not fattening, properties. The herbage, cut on July 21, yielded the following results:—

Gramineous herbage	90	100
Leguminous herbage	8	
Miscellaneous herbage	2	

The grasses were made up as follows:—

Lolium perenne	80	100
Cynosurus cristatus	8	
Phleum pratense	7	
Agrostis sp., Alopecurus pratensis, Hordeum pratense, Holcus lanatus	5	

It is obvious that this was a very pure or "grassy" herbage. The small proportion of leguminous plants consisted entirely of Trifolium repens, and the really insignificant amount of weeds

was made up mostly of Cerastium triviale, the remainder being Ranunculus acris.

No. 3.—A turf sent by Mr. Campbell F. L. Sanctuary, of Mangerton, Sherborne, Dorset, who writes: "The turf comes from a first-rate meadow, about three miles from Bridport. The field from which it comes will fatten cattle in the summer without artificial food." The sample consisted of six or seven inches' depth of loam resting on stiff blue clay. The herbage was cut on July 18, and the botanical analysis gave the following results:—

Gramineous herbage	80	100
Leguminous herbage	5	
Miscellaneous herbage	15	

The grasses were separated with the subjoined results:—

Lolium perenne	76	100
Dactylis glomerata	13	
Cynosurus cristatus	5	
Holcus lanatus	3	
Agrostis sp., Poa trivialis, Festuca ovina, Avena flavescens	3	

The leguminous herbage was composed, in about equal parts, of Trifolium repens and Trifolium pratense. In the weeds Cerastium triviale preponderated, but there were also Ranunculus, Leontodon, Plantago, Veronica, and Bellis, their relative abundance being in the order indicated.

No. 4.—A turf sent by Mr. J. P. Oatway, of Little Marston, Sherborne, Dorset. The land from which it was taken is in the parish of West Camel, Somerset, about 120 feet above the sea-level, and with southern aspect; subsoil, a slaty clay; feeding properties, fattening. The soil in the specimen had the appearance of a stiff ferruginous clay loam. The herbage of this pasture, which was cut on July 23, gave the following percentage results:—

Gramineous herbage	100	100
Leguminous herbage, Miscellaneous herbage	a trace	

The grasses were thus made up:—

Lolium perenne	77	100
Holcus lanatus	9	
Agrostis sp.	8	
Alopecurus pratensis	3	
Cynosurus cristatus	2	
Phleum pratense	1	

There were present trivial quantities of Trifolium repens, and of Cerastium triviale and Ranunculus acris, but the total quantity

of these did not exceed half of one per cent. It may be said that practically the herbage is all grass.

No. 5.—A turf sent by Mr. W. Hancock, of Wiveliscombe, Somerset, who describes it as "what we consider a fair sample of one of our best pasture fields." The soil of the specimen was a bright red loam, and was cut from a dry pasture on the side of a valley. The field faces south, and it has been mown every year excepting the last three years. It is a very good field for sheep and cattle, but is kept chiefly for the latter. It is about a mile west of Wiveliscombe, and is rather over 300 feet above sea-level. The herbage was cut on July 16, and gave the following percentage results:—

Gramineous herbage	70	100
Leguminous herbage	1	
Miscellaneous herbage	29	

The grasses, when separated, were found to be present in the following proportions:—

Lolium perenne	82	100
Agrostis sp.	10	
Holcus lanatus	5	
Anthoxanthum odoratum, Cynosurus cristatus, Poa trivialis	3	

The leguminous herbage was practically Trifolium repens, and the miscellaneous herbage was almost entirely made up of Leontodon sp.

No. 6.—A turf sent by Professor J. P. Sheldon, of Sheen, Ashbourne, who writes that it was dug in the parish of Sheen, North Staffordshire, from a permanent grass field that has not been under the plough for a century, if ever. During the last twenty years or so it has been pastured; previously it was meadowed, pretty regularly, for a long period. In a favourable season, and under good management as to manuring, it will cut about two tons of hay to the acre. Five acres of such land will fatten four shorthorn barreners, between the middle of May and the beginning or middle of August, in a fairly good season; they will afterwards fatten, say, a dozen or fifteen wether sheep. The soil is a deep loam, not needing artificial draining; height above sea-level about 700 feet. The soil of the specimen sent had the appearance of a very friable dark-grey loam. The herbage was of a very mixed character; it was cut on July 24, and yielded:—

Gramineous herbage	32	100
Leguminous herbage	1	
Miscellaneous herbage	67	

A botanical analysis of the grasses gave the following result:—

Dactylis glomerata	27	100
Lolium perenne	18	
Agrostis sp.	17	
Festuca pratensis	13	
Cynosurus cristatus	11	
Holcus lanatus	7	
Avena flavescens	4	
Phleum pratense	2	
Poa trivialis, Anthoxanthum odoratum	1	

The leguminous herbage was exclusively Trifolium repens, and the great bulk (86 per cent.) of the miscellaneous herbage was Rumex Acetosa, the remainder consisting of Ranunculus, Plantago, and one specimen each of Cerastium and Heracleum Sphondylium.

No. 7.—A turf from Mr. C. R. Morris, of North Curry, Taunton, Somerset, who describes it as "some of our best pasture land." The soil of the specimen was a brown clayey loam. This turf showed early signs of an abundant growth of Achillea Millefolium, and at length it became smothered with this plant to an extent which would never be possible in continuously grazed land. Cut on July 17, the herbage gave the following remarkable result on separation:—

Gramineous herbage	11	100
Leguminous herbage	a trace	
Miscellaneous herbage	89	

The grasses were thus constituted:—

Lolium perenne	90	100
Festuca ovina et var.	8	
Cynosurus cristatus, Anthoxanthum odoratum, Poa trivialis, Avena flavescens	2	

The trivial amount of leguminous herbage present consisted of Trifolium repens, whilst the miscellaneous herbage was practically nothing but Achillea Millefolium.

No. 8.—A turf taken from a pasture eight miles north of the town of Thurles, in county Tipperary, Ireland. The soil is a light-brown clay loam, resting upon the Carboniferous Limestone. The feeding properties of the pasture are described as excellent "not only to make the cattle fat, but grows the bone well." Height above the sea about 155 feet. This was a somewhat weedy turf, and late in commencing growth. The herbage was cut on July 24, and yielded:—

Gramineous herbage	49	100
Leguminous herbage	2	
Miscellaneous herbage	49	

The grasses were made up in the following proportions :—

Lolium perenne	66	100
Agrostis sp.	27	
Holcus lanatus	6	
Dactylis glomerata, Cynosurus cristatus, Anthoxanthum odoratum, Poa sp.	1	

The leguminous herbage was chiefly Trifolium pratense, the remainder being Trifolium repens. Rumex Acetosa made up 75 per cent. of the weeds, the remainder consisting of Leontodon, Ranunculus, Plantago, and one specimen of Cerastium.

No. 9.—A turf sent by Mr. Gilbert Murray, of Elvaston, Derby. The specimen had the appearance of a very compact friable loam, chocolate-coloured. Mr. Murray writes that the specimen was cut from a grass field in the parish of Elvaston, county of Derby; that the soil is a deep sandy loam of alluvial origin, resting on a gravelly subsoil, the drainage being perfect except during high floods, when the land is submerged. The exact locality is four miles south of Derby, the elevation about 200 feet above the sea-level, and the average rainfall 28 inches. Concerning its previous history Mr. Murray writes :—

"Permanent pasture for at least sixty years. I have no means of ascertaining how it was laid down. The land has occasionally been mown, but more generally it has been grazed with fattening cattle and dairy cows. In dripping seasons it produces a large quantity of grass. It will fatten cows and heifers, but is not sufficiently strong to graze steers or oxen. It is very suitable for dairy cows, which yield large quantities of milk of good quality. Sheep thrive well in the summer, but do not winter well on the land, particularly lambs or hogs. Shearing wethers do much better, and escape the hoose so fatal to the lambs."

The herbage of this plot, which was cut on July 19, yielded :—

Gramineous herbage	18	100
Leguminous herbage	a trace	
Miscellaneous herbage	82	

The grasses were a very mixed lot, comprising :—

Dactylis glomerata	33	100
Avena flavescens	20	
Festuca ovina	18	
Agrostis sp.	12	
Cynosurus cristatus	7	
Anthoxanthum odoratum	7	
Holcus lanatus	3	

The very trifling amount of leguminous herbage present was composed of Lotus corniculatus and Trifolium repens. Of the

miscellaneous herbage, seven-eighths was Rumex Acetosa, the residue being Plantago lanceolata, Centaurea nigra, Cerastium triviale, Bunium flexuosum, and Ranunculus.

No. 10.—A turf from Mr. Robert E. Tucker, of Ashburton, Devon. This was a friable loam, and the herbage, cut on July 17, had the following percentage composition:—

Gramineous herbage	78	100
Leguminous herbage	6	
Miscellaneous herbage	16	

The grasses were composed thus:—

Lolium perenne	82	100
Phleum pratense	13	
Agrostis sp.	5	

The leguminous herbage was Trifolium repens. Of the miscellaneous herbage, five-sixths was Achillea Millefolium, and the remainder was made up of Rumex crispus (one plant only).

No. 11.—A turf sent through Colonel Curtis-Hayward, of Quedgeley, Gloucestershire, who writes: "The sample is from Berkeley, cut from a meadow just below the castle; it is rich grazing-land of the same description as the grazing-grounds at Slimbridge; the soil is alluvial deposit from the Severn." In the specimen the soil was a dirty, yellowish-brown, plastic clay, becoming darker towards the surface. The herbage, cut on July 21, gave, on separation:—

Gramineous herbage	57	100
Leguminous herbage	38	
Miscellaneous herbage	5	

The grasses were thus made up:—

Lolium perenne	83	100
Agrostis sp.	15	
Dactylis glomerata, Poa trivialis, Holcus lanatus	2	

This was a beautiful piece of pasture, the leguminous herbage consisting entirely of a rich bottom growth of Trifolium repens. The trivial percentage of miscellaneous herbage was made up of Ranunculus acris and Cerastium triviale.

No. 12.—A turf sent by Mr. Robert McKerrow, of Carton, Land-steward to his Grace the Duke of Leinster. Mr. McKerrow writes:—

"The turf was drawn from a meadow in county Kildare, with southerly exposure, and, as far as I can learn, is over seventy years old. The subsoil consists of deep, dry, brown loam, lying on limestone rock. The meadow is covered with a close, firm, deep-rooted turf, free from fog. It grows a rich and luxuriant crop of sweet herbage, which stock eat closely

and thrive extremely well upon. The meadow is considered well suited to grow either beef or mutton. It is grazed at present (February 18) with dairy cows, which develop well upon it, and give abundance of rich produce."

The specimens sent had the appearance of a brownish clay loam, rather stony. The herbage was cut on July 23, and gave the following result:—

Gramineous herbage	65	100
Leguminous herbage	3	
Miscellaneous herbage	32	

The grasses were separated into:—

Lolium perenne	90	100
Dactylis glomerata	8	
Avena flavescens	1	
Cynosurus cristatus, Agrostis sp.	1	

The small quantity of leguminous herbage consisted, to the extent of two-thirds, of Trifolium repens, the remainder being Lotus corniculatus. Six-sevenths of the miscellaneous herbage was made up of Rumex Acetosa; the remainder was Prunella vulgaris, Ranunculus bulbosus, and Cerastium triviale, in the order indicated.

No. 13.—A turf sent by Mr. Frank Minohead, of Cloona Castle, Ballinrobe, county Mayo, who writes as follows:—

"The turf was taken from the best pasture field on this farm. The field lies near Ballinrobe, and so far as I can judge will be 150 feet above sea-level. The soil is a light limestone soil lying on limestone rock, with a depth of earth of 22 inches, and then a subsoil of poor, weak, yellow clay and sand on the particular part of the field where the sample was taken. The field has not been under tillage in the memory of any one about here. It has been pastured by sheep mostly, but black polled cattle have been put into it at nights in the early part of winter, and during the day only as the weather got more severe. The rainfall here will be nearly 40 inches; the soil dries very quickly, even after heavy rain. The rain, as a rule, is well distributed over the whole year, so that the climate is favourable in that respect for grass. The winter is never severe; we have a few days' frost now and then, with a little snow, but fields are rarely unfit for cattle or sheep to procure what grass may be on them. There has been no extra food consumed on the field where the turf was cut for at least six years. The field is always much greener and the grass closer eaten than the generality of this big farm—2,200 acres—showing the quality of the grass to be the best we have."

The specimen had the appearance of a chocolate-coloured loam. The herbage, cut on July 26, gave the following results:—

Gramineous herbage	24	100
Leguminous herbage	6	
Miscellaneous herbage	70	

The grasses were thus composed:—

Lolium perenne	62	100
Agrostis sp.	36	
Dactylis glomerata, Cynosurus cristatus, Holcus lanatus	2	

The leguminous herbage was about equally divided between Trifolium repens and Trifolium pratense, with one plant of Lotus corniculatus. The miscellaneous herbage was made up of Plantago lanceolata (60 per cent.) and Leontodon hispidus (30 per cent.), the remainder being Taraxacum officinale and Ranunculus bulbosus.

No. 14.—A turf from county Meath, the specimen having the appearance of a loose, friable, brown loam, rather stony. The herbage was cut on July 27, and yielded:—

Gramineous herbage	21	100
Leguminous herbage	1	
Miscellaneous herbage	78	

The grasses were thus proportioned:—

Lolium perenne	61	100
Dactylis glomerata	28	
Agrostis sp.	9	
Cynosurus cristatus, Anthoxanthum odoratum, Poa trivialis, Festuca ovina, Holcus lanatus	2	

The small proportion of leguminous herbage was all Trifolium repens. Of the miscellaneous herbage 99 per cent. was made up of Leontodon sp., the produce, however, of only two very robust plants which occupied between them fully one-half the plot, and, of course, smothered the herbage which otherwise would have sprung up there. The rest of the miscellaneous herbage consisted chiefly of Plantago and Ranunculus.

No. 15.—A turf sent by Mr. George Fairbairn, of Dromagh Castle, county Cork, who writes:—

"The meadow rests upon the table-land on which the castle stands, the soil is from 12 to 18 inches deep, and the subsoil is a yellowish clay and sand, varying from 3 to 12 inches thick. It was always the greenest pasture we had last summer (1887), and the grass comes early on it. As it is well sheltered and dry, the dairy cows have been put into it at nights for forty years at least. It is named the Barley Field, as it is said the last crop on it was barley; but the oldest man here does not mind of that. P.S.—Since writing, I have heard from an old man that it is about fifty-five years since the field was tilled."

The specimen appeared to be a somewhat stony brown loam, and was well permeated by roots; the herbage, cut July 26, had the following composition:—

Gramineous herbage	36	100
Leguminous herbage	2	
Miscellaneous herbage	62	

The grasses were:—

Lolium perenne	65	100
Agrostis sp.	35	
Cynosurus cristatus, Poa trivialis	a trace	

The small proportion of leguminous herbage was Trifolium pratense, whilst nearly half the miscellaneous herbage was Rumex Acetosa, the remainder consisting of Leontodon sp., Prunella vulgaris, Ranunculus acris, Centaurea nigra (one plant only), Plantago lanceolata, Cerastium triviale, and Veronica Chamædrys, in the order indicated.

No. 16.—A turf sent by Mr. William Fraser, of Johnstown Castle, county Wexford, who states that the field from which it is cut is of an undulating nature, and about 200 feet above the sea level; it has been in grass for over twenty-five years:—

"The grasses composing the herbage are for the most part crested dogstail, sweet vernal, perennial ryegrass, and some Yorkshire fog. It is not what would be considered a first-rate fattening pasture, and would be better adapted for sheep than cattle. I consider this field about the best and cleanest old pasture we have. I may mention that the vernal grass seems to grow naturally about here in all pastures, and I see it coming thick in some new pasture which I have sown down, though I never sow any of it. The soil of the field is very good brown clay loam to a depth of 9 inches to a foot, resting on a yellow and bluish sandy clay."

The specimen had the appearance of a reddish-brown friable loam, somewhat sticky. Of all the twenty-five turfs the herbage of this was most suggestive of a good typical sheep pasture, quite confirming the opinion contained in Mr. Fraser's letter. The herbage was cut on July 28, and was found to consist of:—

Gramineous herbage	30	100
Leguminous herbage	30	
Miscellaneous herbage	40	

The grasses were made up as follows:—

Agrostis sp.	59	100
Festuca ovina	16	
Lolium perenne	16	
Cynosurus cristatus	5	
Anthoxanthum odoratum	3	
Poa pratensis, Holcus lanatus	1	

Of the leguminous herbage 60 per cent. was Trifolium repens, 30 per cent. was Lotus corniculatus, and the remainder was Trifolium pratense and Lathyrus pratensis. Of the miscellaneous herbage more than 80 per cent. was Achillea Millefolium,

the rest being Ranunculus repens, Potentilla Anserina, Taraxacum, Prunella, and Cerastium.

No. 17.—A turf sent by Mr. James Robertson, of La Mancha, Malahide, co. Dublin, who writes that the pasture from which it was taken is within one mile of the sea, and is considered very good land—indeed, about the best in the county—and has been in pasture for very many years. The specimen had the appearance of a loose, brownish, very friable loam, almost sandy. The herbage was cut on July 26, and yielded:—

Gramineous herbage	36	100
Leguminous herbage	22	
Miscellaneous herbage	42	

The grasses were made up thus:—

Lolium perenne	86	100
Dactylis glomerata	10	
Festuca ovina	3	
Cynosurus cristatus, Bromus mollis, Briza media, Poa trivialis	1	

Of the leguminous herbage, seven-eighths consisted of Trifolium pratense, the remainder being Trifolium repens. Three-fourths of the miscellaneous herbage was Plantago lanceolata, the remainder consisting of Cerastium triviale, Ranunculus, and Taraxacum.

No. 18.—A turf sent by Mr. P. J. O'Dwyer, of Ennistymon, co. Clare. It was drawn from a piece of old grazing-land within two miles of the sea, in the parish of Doolin, near Lisdoonvarna, co. Clare. The specimen had the appearance of a stiff, stony clay, varying in colour from dull reddish to yellowish and bluish. The herbage, cut on July 18, yielded the following percentage composition:—

Gramineous herbage	44	100
Leguminous herbage	6	
Miscellaneous herbage	50	

The grasses were thus composed:—

Lolium perenne	86	100
Agrostis sp.	7	
Dactylis glomerata	4	
Cynosurus cristatus, Holcus lanatus	3	

The small percentage of leguminous herbage consisted of Trifolium repens. Of the miscellaneous herbage, over 90 per cent. was Rumex Acetosa, the remainder being Plantago lanceolata, Ranunculus sp., Cerastium triviale, and Veronica Chamædrys.

No. 19.—A turf from a rich old pasture in Buckinghamshire, the soil being a dark-brown loam of very good quality. From the time this sod was planted, at the end of January, to the day when the herbage was cut, on July 18, it always presented a beautiful appearance, and it won the admiration of all who saw it. The herbage was composed of:—

Gramineous herbage	95	100
Leguminous herbage	5	
Miscellaneous herbage	a trace	

The grasses were in the following proportions:—

Lolium perenne	80	100
Phleum pratense	15	
Agrostis sp.	3	
Alopecurus pratensis, Cynosurus cristatus, Holcus lanatus, Poa trivialis	2	

The leguminous herbage was all Trifolium repens, and the only miscellaneous plant present was Ranunculus.

No. 20.—A turf sent by Mr. Louis T. Delcomyn, of The Old Court, Bredwardine, Herefordshire, who writes: "It is a fair specimen of our uplands old pasture, and is never touched by the floods which we have in winter over the greater part of our pastures. It comes from a pasture called 'The Radnor,' and is used chiefly for sheep, but they seldom get cake while on it." The specimen was a rich, reddish, friable loam, and the turf was absolutely free from weeds. The herbage, a choicer natural sample than which it would be difficult to find, was cut on July 23. Nothing can so eloquently describe this excellent turf as the following brief table showing the percentage composition of the herbage:—

Gramineous herbage (exclusively Lolium perenne)	88	100
Leguminous herbage (exclusively Trifolium repens)	12	
Miscellaneous herbage	0	

Of course, in this case, Lolium perenne forms 100 per cent. of the grasses, and Trifolium repens 100 per cent. of the clovers.

No. 21.—This and the two following turfs were sent through the courtesy of the Marquis of Bath, and the information concerning the lands whence they were drawn is supplied by Mr. H. Fry, his lordship's bailiff at Longleat. No. 21 comes from Corsley Meadows, Longleat, Wilts. It is old grass land of the best quality, possessing excellent fattening properties; was formerly, twenty-five years ago, a water meadow. It is now mown almost every year, and Scotch oxen graze the aftermath for Christmas beef. The specimen had the appearance of a brown stony loam

resting on a pale adhesive clay. The herbage was cut on July 21, and was composed as follows:—

Gramineous herbage	95	100
Leguminous herbage	3	
Miscellaneous herbage	2	

The grasses proper afforded the following percentages:—

Lolium perenne	88	100
Agrostis sp.	7	
Holcus lanatus	4	
Cynosurus cristatus, Alopecurus pratensis, Poa trivialis, Festuca ovina et var.	1	

The leguminous herbage consisted of small quantities of Trifolium repens, Trifolium pratense, and Lathyrus pratensis. Such miscellaneous herbage as was present consisted of Ranunculus acris.

No. 22.—A turf from Webb's Meadows, Longleat, Wilts. This was drawn from grass land at least sixteen years old, which has the reputation of being the best butter-making pasture on the estate. Mr. Fry says the dairymaid can tell when the cows are in this pasture, there being more cream and a different flavour to the butter. When this land is mown the hay requires a great deal of drying. The specimen presented the appearance of a light-brown friable loam. The herbage, cut on July 24, yielded:—

Gramineous herbage	45	100
Leguminous herbage	3	
Miscellaneous herbage	52	

The grasses were composed as follows:—

Festuca ovina et var.	57	100
Holcus lanatus	15	
Festuca pratensis	11	
Lolium perenne	10	
Agrostis sp.	6	
Anthoxanthum odoratum, Cynosurus cristatus	1	

The leguminous herbage consisted of Trifolium pratense and Lotus corniculatus. Six-sevenths of the miscellaneous herbage was Plantago lanceolata, the remainder being Rumex Acetosa, Prunella vulgaris, Ranunculus bulbosus, and Cerastium triviale. During growth, the herbage of this plot was seen to be of a very heterogeneous character.

No. 23.—A turf from St. Alger's Farm, Woodlands, near Frome, Somerset—the Selwood Forest district. The sample was drawn from a celebrated Cheddar cheese pasture. It used

to yield excellent cheese, which made the highest price in the district, but the produce has not been so good since the land was drained some ten years ago. The specimen had the appearance of a light-brown loam resting on gravel. The herbage, cut on July 25, yielded the following results:—

Gramineous herbage	88	100
Leguminous herbage	6	
Miscellaneous herbage	6	

The grasses were made up in the following proportions:—

Lolium perenne	86	100
Phleum pratense	10	
Holcus lanatus	3	
Agrostis sp.	1	
Alopecurus pratensis, Poa trivialis	a trace	

The leguminous herbage was exclusively Trifolium repens, and the miscellaneous herbage Ranunculus repens. Of the three turfs, Nos. 21, 22, 23, the herbage of this was the greenest, the most homogeneous, and apparently the best.

No. 24.—This turf was made up of five sections drawn from five different fields in Romney Marsh, Kent, all fatting land. The specimens were sent by Mr. Alfred Hutchinson, of New Romney, Kent. The herbage, cut on July 23, contained:—

Gramineous herbage	79	100
Leguminous herbage	21	
Miscellaneous herbage	0	

The grasses comprised:—

Lolium perenne	97	100
Avena flavescens, Agrostis sp.	3	
Cynosurus cristatus, Poa trivialis	a trace	

The leguminous herbage consisted entirely of Trifolium repens. My observation on this herbage in the third week of June appears thus in my note-book: "Very good; nearly all grass, some clover, no weeds."

No. 25.—A turf sent by Mr. Thomas Nuttall, of Beeby Manor, Leicester. This turf was cut from the famous Stilton cheese pastures in Leicestershire, and the specimen had the appearance of a stiff rich brownish clay, easily drying. The herbage was cut on July 30, and yielded the following results:—

Gramineous herbage	58	100
Leguminous herbage	42	
Miscellaneous herbage	a trace	

The grasses were represented in the following proportions:—

Lolium perenne	67	100
Dactylis glomerata	26	
Agrostis sp.	6	
Phleum pratense, Cynosurus cristatus	1	

The leguminous herbage consisted to the extent of over 98 per cent. of Trifolium repens, the rest being Trifolium pratense.

The table (I.) showing the distribution of species, which is given on page 438, may be regarded as a summary of the results obtained. In it are named all the gramineous species, all the leguminous species, and seven of the most noticeable miscellaneous species detected amongst the herbage of the twenty-five turfs. Seventeen species of grasses are enumerated, but, if Agrostis sp. be regarded as denoting two species and Festuca ovina et var. as denoting three species, the number is brought up to twenty, as compared with twenty-six species of grasses found upon the water meadows, or with twenty species of grasses which have been identified on the variously manured plots in Rothamsted Park. The table is, of course, strictly qualitative, and not in any sense quantitative. For example, Briza media was represented by a solitary plant found upon one plot only, and Poa annua, a weed grass, though recorded for six plots, was never present save in very insignificant quantity. The total number of leguminous species represented was only four, as compared with seven on the water meadows and ten in Rothamsted Park. The list of miscellaneous species might be continued to a much greater extent, but the seven which are enumerated in the table include the really significant ones, the others being in very small quantity and more of botanical than of agricultural interest. The table is further useful as being a census of species, recording as it does the relative frequency of occurrence, in different localities, of each plant mentioned. In this respect the premier position is taken by Lolium perenne amongst the grasses, and by Trifolium repens amongst the leguminous plants. The greatest number of species of grass which occurred on any plot was ten on one of the Kent turfs (No. 2), on the Stafford turf (No. 6), and on the Tipperary turf (No. 8); the least number was three on the Herefordshire turf (No. 20). Not one of the turfs was utterly destitute of leguminous plants, though on fifteen of them only one species was represented, and only on the Wexford turf (No. 16) did all four species occur.

It is possible, however, to present a quantitative view of the results, as is done in table (II.) of percentages by weight of green herbage (page 439). This table shows that in fifteen cases the

I. Table Showing the Distribution of Species on the Turfs.

No.	Species present	Total Occurrences	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
			Lincoln	Kent	Dorset	Dorset	Somerset	Stafford	Somerset	Tipperary	Derby	Devon	Gloucester	Kildare	Mayo	Meath	Cork	Wexford	Dublin	Clare	Bucks	Hereford	Wilts	Wilts	Somerset	Kent	Leicester
	Gramineous																										
1	Lolium perenne	24	*	*	*	*	*	*	*	*	—	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
2	Agrostis sp.	21	*	*	—	*	*	*	—	*	*	*	*	*	*	*	*	*	—	*	*	—	*	*	*	*	*
3	Cynosurus cristatus	21	*	*	*	*	*	*	*	*	*	—	—	*	*	*	*	*	*	*	*	—	*	*	—	*	*
4	Holcus lanatus	20	*	*	*	*	*	*	—	*	*	*	*	—	*	*	—	*	*	*	*	—	*	*	*	—	*
5	Poa trivialis	19	*	*	*	—	*	*	*	*	*	*	*	—	—	*	*	—	*	—	*	*	*	—	*	*	*
6	Anthoxanthum odoratum	12	—	*	—	*	*	*	*	*	*	—	—	*	*	*	—	*	—	—	—	—	—	*	—	—	—
7	Dactylis glomerata	12	*	—	*	—	—	*	—	*	*	—	*	*	*	*	—	—	*	*	—	—	—	—	—	—	*
8	Festuca ovina et var.	11	*	*	*	—	—	—	*	*	*	—	—	—	—	*	—	*	*	—	—	—	*	*	—	—	—
9	Phleum pratense	9	—	*	*	*	—	*	—	—	—	*	—	—	—	—	—	—	—	—	*	—	*	—	*	—	*
10	Avena flavescens	8	*	—	*	—	—	*	*	*	*	—	—	*	—	—	—	—	—	—	—	—	—	—	—	*	—
11	Alopecurus pratensis	6	—	*	—	*	—	—	—	—	—	—	—	—	—	*	—	—	—	—	*	—	*	—	*	—	—
12	Poa annua	6	—	—	—	—	—	—	—	*	—	*	—	—	—	—	—	—	*	*	—	*	—	—	*	—	—
13	Hordeum pratense	4	—	*	—	*	—	—	—	—	—	—	*	—	—	—	—	—	—	—	—	—	—	—	—	—	*
14	Festuca pratensis	3	—	—	*	—	—	*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*	—	—	—
15	Bromus mollis	2	*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*	—	—	—	—	—	—	—	—
16	Briza media	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*	—	—	—	—	—	—	—	—
17	Poa pratensis	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*	—	—	—	—	—	—	—	—	—
	Total		9	10	9	8	6	10	6	10	8	6	6	6	6	9	4	7	9	6	7	3	8	7	7	5	8
	Leguminous																										
18	Trifolium repens	22	*	*	—	*	*	*	*	*	*	*	*	*	*	*	—	*	*	*	*	*	*	—	*	*	*
19	Trifolium pratense	10	—	—	*	—	*	—	—	*	—	—	—	—	*	—	*	*	*	—	—	—	*	*	—	—	*
20	Lotus corniculatus	5	—	—	—	—	—	—	—	—	*	—	—	*	*	—	—	*	—	—	—	—	—	*	—	—	—
21	Lathyrus pratensis	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*	—	—	—	—	*	—	—	—	—
	Total		1	1	1	1	2	1	1	2	2	1	1	2	3	1	1	4	2	1	1	1	3	2	1	1	2
	Miscellaneous																										
22	Ranunculus sp.	22	*	*	*	*	*	*	*	*	*	—	*	*	*	*	*	*	*	*	*	—	*	*	*	—	*
23	Cerastium triviale	18	*	*	*	*	—	—	*	*	*	—	*	*	*	*	*	*	*	*	—	—	—	*	*	—	*
24	Plantago lanceolata	10	—	—	*	—	—	*	—	*	*	—	—	—	*	*	*	—	*	*	—	—	—	*	—	—	—
25	Rumex Acetosa	9	*	—	—	—	—	*	—	*	*	—	—	*	—	*	*	—	—	*	—	—	—	*	—	—	—
26	Leontodon sp.	8	—	—	*	—	*	—	—	*	—	—	—	*	*	*	*	—	—	—	—	—	—	*	—	—	—
27	Prunella vulgaris	6	—	—	—	—	—	*	—	—	—	—	—	*	*	—	*	*	—	—	—	—	—	*	—	—	—
28	Achillea Millefolium	3	—	—	—	—	—	—	*	—	—	*	—	—	—	—	—	*	—	—	—	—	—	—	—	—	—
	Total		3	2	4	2	2	4	3	5	4	1	2	5	5	5	6	4	3	4	1	0	1	6	2	0	2
	Grand Total on each Turf		13	13	14	11	10	15	10	17	14	8	9	13	14	15	11	15	14	11	9	4	12	15	10	6	12

II. TABLE SHOWING THE PERCENTAGES BY WEIGHT OF GREEN HERBAGE (GRAMINEOUS, LEGUMINOUS, AND MISCELLANEOUS) UPON EACH TURF.

Species present	1 Lincoln	2 Kent	3 Dorset	4 Dorset	5 Somerset	6 Stafford	7 Somerset	8 Tipperary	9 Derby	10 Devon	11 Gloucester	12 Kildare	13 Mayo	14 Meath	15 Cork	16 Wexford	17 Dublin	18 Clare	19 Bucks	20 Hereford	21 Wilts	22 Wilts	23 Somerset	24 Kent	25 Leicester
Gramineæ	75	90	80	100	70	32	11	49	18	78	57	65	24	21	36	30	36	44	95	88	95	45	88	79	58
Leguminosæ	11	8	5	—	1	1	—	2	—	6	38	3	6	1	2	30	22	6	5	12	3	3	6	21	42
Miscellaneæ	14	2	15	—	29	67	89	49	82	16	5	32	70	78	62	40	42	50	—	—	2	52	6	—	—
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

III. TABLE SHOWING THE PERCENTAGES BY WEIGHT OF SPECIES IN THE GRAMINEOUS HERBAGE OF EACH TURF.

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Lolium perenne	67	80	76	77	82	18	90	66	—	82	83	90	62	61	65	16	86	86	80	100	88	10	86	97	67
Agrostis sp.	—	—	—	8	10	17	—	27	12	5	15	—	36	9	35	59	—	7	—	—	7	6	—	—	6
Cynosurus cristatus	—	8	5	—	—	11	—	—	7	—	—	—	—	—	—	5	—	—	—	—	—	—	—	—	—
Holcus lanatus	—	—	—	9	5	7	—	6	—	—	—	—	—	—	—	—	—	—	—	—	—	15	—	—	—
Anthoxanthum odoratum	—	—	—	—	—	—	—	—	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dactylis glomerata	20	—	13	—	—	27	—	—	33	—	—	8	—	28	—	—	10	—	—	—	—	—	—	—	26
Festuca ovina et var.	—	—	—	—	—	—	8	—	18	—	—	—	—	—	—	16	—	—	—	—	—	57	—	—	—
Phleum pratense	—	7	—	—	—	—	—	—	—	13	—	—	—	—	—	—	—	—	15	—	—	—	10	—	—
Avena flavescens	—	—	—	—	—	—	—	—	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Festuca pratensis	—	—	—	—	—	13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11	5	—	—
Other grasses	13	5	6	6	3	7	2	1	3	0	2	2	2	2	0	4	4	7	5	0	5	1	—	3	1
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

gramineous herbage formed more than 50 per cent. of the total, and that in the remaining ten cases the advantage was with the miscellaneous herbage. In table (III.) on the same page, showing the percentages by weight of species in the gramineous herbage, only those species are recorded which were present to the extent of at least 5 per cent. of the gramineous herbage. It may be seen that Lolium perenne was first in twenty-one cases, Dactylis glomerata in two cases (No. 6, Staffordshire, and No. 9, Derbyshire), Agrostis sp. once (No. 16, Wexford), and Festuca ovina et var. once (No. 22, Wiltshire).

The remarkable proportion of miscellaneous herbage in some cases, amounting indeed to as much as 89 per cent. on the Somerset turf (No. 7), is probably to a great extent attributable to the circumstances under which the turfs were allowed to grow. Certainly, under the normal treading and grazing of stock, such species as Achillea Millefolium, Leontodon sp., and Rumex Acetosa, would never make the display which characterised several of the turfs. An interesting case in point is afforded by the Derbyshire turf (No. 9). This yielded as much as 70 per cent. of Rumex Acetosa, and, without mentioning this circumstance, I wrote to Mr. Gilbert Murray to ask whether or not this plant occurs in any quantity on the pasture. His reply, dated July 25, is—"There is very little sorrel or sour dock noticeable, and as the land is kept closely grazed I have little opportunity of ascertaining the names of the grasses." This quite coincides with the opinion I had formed that in well-grazed pastures the bulky miscellaneous species are kept down, whilst the freely tillering grasses supply a large ratio of the effective herbage.

The principle of expressing the grasses in percentages of the gramineous herbage only has been adopted because it serves to bring out in a more significant manner the relative degree in which the various gramineous species are developed. The remarkable abundance which the figures assign to Lolium perenne merely corroborates what had been anticipated from constant observations of the turfs during growth. Dactylis glomerata, though a bulky grass and weighing heavily, was present on only half the turfs; and even in its greatest abundance (the Derbyshire turf, No. 9) it made up only one-third of the gramineous herbage. It is significant that not a single specimen of Avena elatior was detected in the whole series of turfs; whilst the broad-leaved fescues, of which Festuca pratensis may be taken as the type, made but a poor show. As regards the leguminous herbage the premier position is taken

easily by Trifolium repens; whilst it deserves to be noted that Medicago lupulina was never once discovered.

The verdict which these turfs have given in favour of Lolium perenne and Trifolium repens has led me to look elsewhere in order to discover, if possible, any confirmatory evidence. In France the rich grass lands of Normandy do not differ greatly in their climatal surroundings from many of those of England, and a knowledge of their botanical composition would for purposes of comparison be very valuable. In a recently published work, "Herbages et Prairies naturelles," the outcome of thirty years' patient study and observation, M. Amédée Boitel, Membre de la Société nationale d'Agriculture, supplies information of the kind required. The meadows and pastures of Normandy, M. Boitel tells us, are everywhere of good quality. In 1885 very exact observations were made upon the pastures of Cotentin, the native home of the Cotentin breed of cattle. A good meadow situated near Saint-Lô, due south of Isigny and west of Caen, and resting on a schistose soil, yielded 50 per cent. of gramineous herbage, 40 per cent. of leguminous herbage, and 10 per cent. of miscellaneous herbage. The grasses, arranged in the order of their abundance, are:—

Lolium perenne, Holcus lanatus — very common

Cynosurus cristatus, Dactylis glomerata, Poa pratensis, Poa trivialis — common

Anthoxanthum odoratum, fairly common

Agrostis alba, Bromus mollis, Festuca elatior — rare

The leguminous herbage is made up almost entirely of Trifolium repens and Trifolium pratense.

In the Duchy of Coigny, in the Department of the Manche, the best pastures rest upon an old alluvium, enriched by the calcareous detritus of oolitic rocks. The herbage is 60 per cent. gramineous and 40 per cent. leguminous, the miscellaneous species being utterly insignificant in quantity. The grasses are the following:—

Holcus lanatus, very common

Lolium perenne, Anthoxanthum odoratum, Bromus mollis — common

Cynosurus cristatus, Poa pratensis, Festuca rubra — fairly common

Dactylis glomerata, rare

The leguminous plants are chiefly Trifolium repens, Trifolium pratense, and Trifolium minus, the remainder being Lotus corniculatus.

The pastures of Isigny rest upon a very fertile fluvio-marine alluvium, and are classed among the most fertile and the most productive of France. One of these celebrated pastures, situated

between the mouths of the rivers Vire and Aure, yielded 70 per cent. of gramineous herbage and 30 per cent. of leguminous herbage. The grasses are the following :—

Hordeum pratense, extremely common	Cynosurus cristatus, Lolium perenne, Dactylis glomerata, Holcus lanatus — in moderate quantity
Avena flavescens, very common	
Poa trivialis, common	

The leguminous herbage is composed of Trifolium repens and Trifolium pratense, the former largely preponderating. The only miscellaneous weeds present are thistle and buttercup, but these are utterly insignificant in quantity. Two other pastures situated upon the right bank of the Vire have the same botanical composition, but with a larger proportion of leguminous herbage; this latter indeed, chiefly Trifolium repens, probably makes up half the bulk.

The pastures in the valley of the Auge are devoted exclusively to the fattening of cattle and sheep, and, in examining these grass lands, the observer is at once impressed with the purity of the herbage. Save for a few thistles and buttercups, representing together not one-fiftieth part of the total herbage, there is nothing but grasses and clovers. The thistles are cut down and left to wither, in which state they are readily eaten by the cattle. The herbage consists of from 50 to 60 per cent. of grasses, and from 40 to 50 per cent. of leguminous plants. The grasses are :—

Cynosurus cristatus, very common
Lolium perenne, Poa trivialis — common

The other grasses are Anthoxanthum odoratum, Poa pratensis, Dactylis glomerata, Hordeum pratense, Alopecurus pratensis, Festuca rubra, Holcus lanatus, and Agrostis vulgaris, which are present in only small proportions, about equally divided. The leguminous herbage is almost entirely Trifolium repens, the proportion of Trifolium pratense, which makes up the remainder, being small. In fact, Trifolium repens is the most abundant and the best grazed plant in these pastures.

Another pasture, situated on a slope above the same valley, and employed for the fattening of horned stock—five acres fatting four bullocks—is composed of 50 per cent. grasses and 50 per cent. leguminous plants. The grasses are :—

Poa trivialis, very common	Phleum pratense, Alopecurus pratensis, Agrostis vulgaris, Anthoxanthum odoratum — in small quantity
Lolium perenne, Dactylis glomerata, Cynosurus cristatus — common	

The leguminous herbage is composed almost entirely of Trifolium repens, the remainder being Trifolium pratense.

It is not explained how the estimates given in the foregoing notes on the Normandy pastures were arrived at, but it is obvious that, throughout, a very creditable position is assigned to Lolium perenne, whilst Trifolium repens appears to be even more abundant than the results obtained from my experimental turfs would indicate to be the case in English grass lands.

But another piece of evidence, from a very high authority, is forthcoming. In the second edition of Mr. Martin J. Sutton's "Permanent and Temporary Pastures" it is stated (page 51, footnote) that—

> "Sir John B. Lawes visited Leicestershire for the express purpose of examining the famous ox-pastures of that county, and subsequently had the herbage of the best two pastures carefully analysed. The report establishes beyond a shadow of doubt the fact that Lolium perenne is the grass of which the pastures in question principally consist, and that it must have existed in them for more than forty years, although during that time it has never been allowed to seed. Further, it is clearly shown that the pastures actually owe their high reputation to the abundant presence of perennial ryegrass and white clover."

An interesting confirmation of this is afforded by the results yielded in the case of the Leicestershire turf, No. 25.

Independently, however, of the testimony just given, I am able, through the kindness of Sir John Lawes and Dr. Gilbert, to quote here some extremely valuable quantitative results showing "the composition of the herbage of very good fattening pasture, Mr. Fisher's meadow, Market Harborough, Leicestershire." Sir John Lawes has subjected the herbage of this pasture to botanical analysis on eleven occasions in four different years, namely, twice in 1879 (May 31, June 21), six times in 1880 (May 20, 31, June 25, July 6, 21, August 6), twice in 1882 (May 22, June 28), and once in 1888 (July 6). From the figures recording the mean results for each of these four years I have calculated the following mean percentage results for the entire series of eleven botanical separations:—

Gramineous herbage	76	100
Leguminous herbage	21	
Miscellaneous herbage	3	

The following are the mean percentages of grasses:—

Lolium perenne	36	100
Agrostis vulgaris	17	
Poa trivialis	9	
Cynosurus cristatus	8	
Holcus lanatus	6	
Poa annua	5	
Phleum pratense	5	
Dactylis glomerata	4	
Festuca ovina	2	
Avena flavescens	1	
Other grasses	7	

The "other grasses" include nine species, but of these, Aira cæspitosa, Avena pubescens, Bromus mollis, and Festuca pratensis were detected each in one year only; Poa pratensis and Briza media each in two years only; Anthoxanthum odoratum in three of the years; and Alopecurus pratensis and Hordeum pratense in all four years. The lowest percentage of Lolium perenne was recorded in 1879 (28 per cent.), and the highest in 1882 (50 per cent.), but this species was always first amongst the grasses, whilst no other grass secured for itself an invariable position. Of the leguminous herbage more than 99 per cent. is Trifolium repens, the remainder being Trifolium pratense.

It is with considerable satisfaction I avail myself of the permission given me by Sir John Lawes and Dr. Gilbert to quote these results, but I think it right to state that the whole of the results obtained upon my own turfs were already in the printer's hands before I had seen the figures just quoted.

In Mr. James A. Caird's valuable paper[1] on "Recent Experiences in laying down Land to Grass," he speaks of "the evident perennial nature of the ryegrass on Newcastle Town Moor." And visitors to the Royal Agricultural Society's Show at Nottingham in July, 1888, can hardly have failed to notice, in Wollaton Park, the abundance of Lolium perenne near the hoardings, and in other places where the herbage had been allowed to grow.

During the season, and whilst the turfs were in growth, they were inspected at Downton by many agriculturists from different parts of the country, and the noteworthy preponderance of Lolium perenne and Trifolium repens was obvious to all observers; so much so, in fact, that before half the plots had been looked at I got quite accustomed to hear the remark, "They seem to be mostly ryegrass and white clover." Amongst the gentlemen to whom I had the pleasure of showing the experiments was Mr. William Young, J.P., an experienced Irish agriculturist, and the abundance of ryegrass led to some conversation between us, as a result of which Mr. Young kindly sent me a letter from which I extract the following salient points:—

"I had paid a visit to Sharsted Court in June, 1884, and being pleased with the appearance of the recently laid down pastures there, concluded to adopt a modification of the seeding recommended by Mr. Faunce de Laune. Accordingly, in the spring of 1885, having twenty English acres to lay down, I adopted the seeding named below. The land was a good loam resting on limestone rock and limestone gravel, it had been well manured, and had grown a good crop of mangels and swedes—half the crop eaten on the land by sheep, consuming at the same time cake and corn. It was

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[1] *Journal of the Royal Agricultural Society*, Part I., 1888, p. 148.

thoroughly clean; the seeds were sown down with barley and grew well. I did not allow either sheep or cattle upon the young grass, but mowed it for hay when the grasses were just coming into flower in 1886. It gave a heavy crop of excellent hay, and since then it has been pastured by sheep and cattle, eating cake most of the time.

"The grass seeds were obtained from two of the best known English firms, were guaranteed pure, came in separate bags, and were mixed under my own inspection. The quantities used were, per English acre:—

	lbs.		lbs.
Meadow foxtail . .	10	Timothy	5
Cocksfoot . . .	7	Red clover (perennial) .	2
Tall fescue . . .	3	White clover (perennial) .	2
Meadow fescue . .	6	Alsike clover . . .	2

37 lbs. per acre.

No appreciable difference, further than what might be caused by slight variations in the soil itself, was observed between the seeds supplied by the two firms.

"To see the effect, however, of an addition of perennial ryegrass I added to the above seeding on one and a half acre, right across the field, one bushel of perennial ryegrass (weighing 26 lbs. per bushel), say about 16 lbs. per acre. The result, broadly speaking, is that there is now no difference in appearance between the portion in which the ryegrass was sown and that where there was none. There is little ryegrass now in either portion—about as much in one as in the other—showing that where it was sown it has died out in three years to a considerable extent, and where none was sown a small quantity has come naturally, either from seeds being in the land or from falling out of the hay chaff given the sheep in racks in the pasture. The natural grasses and clovers have made quite as good and thick pasture where the ryegrass was sown as where it was not, but for the first hay crop and for the after-grass, and for the next year's pasture, that in which ryegrass was sown was a much heavier crop.

"The net result is that I shall never again omit, say, 14 to 16 lbs. ryegrass from any mixture for permanent pasture.

"Brockley Park, Stradbally, Queen's Co.:
July 24, 1888."

In connection with this instructive record of Mr. Young's experience, the following extract from Mr. James A. Caird's paper, already referred to, is full of interest:—

"The question as to the perennial nature of ryegrass cannot be said to be solved by my inquiries. The opinions are nearly equally divided. Some of my correspondents maintain that it dies out and utterly disappears in two or three years, while others believe either that it is perennial, or that it seeds itself and so continues. There is, however, a nearly unanimous testimony in favour of sowing it in various quantities in permanent grass mixtures, the object being apparently to secure a crop of some kind while the grasses of more tardy growth are developing."

The results which have now been discussed are based upon observations made upon samples of permanent grass lands obtained from an area bounded by Lincolnshire in the north and Devonshire in the south, by Kent in the east and Clare and

Mayo in the west. It might be objected that the turfs were not large enough to be representative, but it is very doubtful whether half a dozen or even a dozen such turfs from the same field would have yielded average results much different from those actually obtained, or whether the relative positions of the various gramineous and leguminous species would have undergone any material alteration. Again, although every species of plant, identified upon each plot, was noted, the percentage composition by weight would no doubt have been different had the mowing taken place earlier or later. With earlier cutting, Alopecurus pratensis and Anthoxanthum odoratum would have made a better show, with later cutting the advantage would have been in favour of Phleum pratense. And yet again, the season is known to be a potent factor in determining the character of the herbage of grass land. In their masterly memoir describing the Rothamsted experiments upon the mixed herbage of permanent meadow, Sir John Lawes and Dr. Gilbert arrive at the conclusion ("Phil. Trans." Pt. I. 1880, p. 405) that "a given quantity of gross produce of the mixed herbage may be one thing in one season and quite another in another season, both as to the proportion of the different species composing it and their condition of development and maturity."

Against such objections as I have endeavoured to anticipate I venture to place one weighty circumstance, and that is the wide area from which the twenty-five turfs were collected. When it is remembered that these turfs were drawn from twelve English and seven Irish counties, when it is borne in mind that they were selected by men of sound agricultural experience as representative of the best old grass land of their respective districts, and when it is recollected also that each turf continued to grow upon its own soil, then it cannot but be admitted that the general result should be trustworthy. And if there is one fact which, more clearly than any other, is demonstrated in the results obtained, it is the position taken by Ryegrass and White Clover, which appear to constitute the backbone—if I may so express it—of many of our best grass lands.

Though other profitable lines of inquiry are suggested by the results which have been recorded, it is not possible to discuss them within the limits of this paper. The method of experiment which has been described might with advantage be still further extended amongst the best grass lands of different parts of the kingdom. By this means we should arrive at an exact knowledge of the constitution of pasture herbage such as we have never yet possessed, and the information would be of

the greatest value in indicating the lines along which the methods of sound agricultural practice should proceed.

I desire to thank all those gentlemen who were good enough to send me samples of their grass land. My special thanks are due to the President of the Surveyors' Institution (Mr. E. P. Squarey), who possesses a wide and intimate knowledge of our English pastures, and to Mr. James Robertson, of La Mancha, Malahide, who enjoys an equally extensive acquaintance with the grass lands of Ireland. To the kind introductions afforded me by Mr. Squarey and Mr. Robertson I am indebted for quite one-half of the turfs included in the experiments.

XXIII.—*Practical Experiences in the Preparation of Food for Stock.* By Henry F. Moore, Frome, Somerset.

During the past few years a great deal of attention has been directed, chiefly in Germany and the United States, to the question of the preparation of food for the live stock of the farm, chiefly and especially to the ideal proportions of food for various purposes. Thus there have arisen chemists who will give an exact food to produce a milk for a given purpose, the only factor taken into account being the weight of the cow. This phase of the feeding question is so purely ideal and so unpractical that it is not likely to have any very long life. Feeding—like all other farming operations—depends so much on the resources of a farm (the best being made of what is actually at hand, helped judiciously, it may be, by purchases) that ideal feeding is next to impossible. With, however, this aspect of the question, other incidental matters have become involved, and these certainly merit attention. In what form should food generally be given to stock, and is there economy or loss in its more careful preparation either by chaffing, mixing, cooking, or steaming? This is essentially a question for the practical man, and how far the answer is regulated or modified by circumstances of locality or management is well worthy of attention.

In order to bring out a record of practical experience on this point, I addressed inquiries to some two hundred well-known agriculturists, asking them to give me their experience and practice as to (1) chaffing, (2) mixing, (3) cooking, and (4) steaming foods. On each of these points questions were asked, in answer to which I have obtained a vast amount of practical information. The questions were as follows:—

Schedule of Questions.

1 and 2. [Do not relate to the subject under discussion.]

3. Do you use straw for feeding purposes?

4. If so, what substitute do you use for litter, and what is the cost as compared with straw?

5. Is the straw chaffed?

6. Is hay given chaffed or unchaffed?

7. In your experience what usefulness or economy is there in using these foods chaffed as compared with unchaffed?

8. What other foods do you generally use, and are they given mixed?

9. If so, (*a*) What are the actual quantities and proportions of the mixtures? (*b*) What are the quantities given per head per day? (*c*) What are the times of feeding?

10. What are the foods you give to (*a*) Horses; (*b*) Dairy Stock; (*c*) Fattening Beasts; (*d*) Breeding Sheep; (*e*) Fattening Sheep, and (*f*) Swine, respectively?

11. What are your general arrangements and methods of feeding in summer and winter respectively?

12. Do you use brewers' grains, and, if so, what is your practice in storing, salting, preserving, and feeding?

13. What saving do you find in the use of chaffed and mixed foods, and how do the animals thrive, (*a*) With regard to milk, butter, and cheese yields; and (*b*) With regard to fattening?

14. Are you in the habit of cooking or steaming foods for your stock, and if so, what is your practice?

15. What are the foods cooked or steamed, and the proportions of the mixtures?

16. What, in your opinion, is the cheapest method of cooking or steaming foods?

17. What benefit have you derived from the system?

18. For what stock would you recommend this method?

19. Have you tried the giving of warm food and water in the winter to dairy or other stock, and if so, with what result? [1]

To these questions the following are some of the answers received:—

Sir J. B. Lawes, Bart., F.R.S., LL.D., *Rothamsted, St. Albans, Herts.*

3. All oat straw; some wheat straw. 4. No substitute.

5. Yes. 6. All chaffed. 7. Much less waste.

10. No sheep are kept. *Dairy cows* (50 to 60) when in milk have decorticated cotton-cake all the year round, about 4 lbs. per day in summer, 4 lbs. to 6 lbs. or 7 lbs. in winter, according to the yield of milk; also in winter, 4 lbs. of bran per day, chaff (half hay and half straw), mangolds, 50 lbs. to 60 lbs. per day, according to the crop; also ensilage instead of part of the mangold.

11. Oxen fattening on grass in summer, 5 lbs. to 7 lbs. cotton-cake daily;

[1] Where numbers corresponding to any of these questions do not appear in the replies which follow, it should be understood that the question is answered in the negative, or that the writer has no experience to record

[*For Schedule of Questions, see page* 448.]

Sir J. B. LAWES—continued.

in winter, cotton-cake, sometimes maize or rice, mangolds, hay. Oxen should increase about 1 lb. for each 10 lbs. or 12 lbs. of dry food consumed.

12. No.

14. No. The Woburn experiments, which were carried out many years ago, were not favourable to cooking, and the more recent German experiments are against it.

Mr. HENRY SIMMONDS, *Bearwood Farm, Wokingham.*

3. Not to any very considerable extent; chiefly as a mixture with hay in equal proportions for chaff.

4. Moss litter is used, but only in a small way. Do not consider, to a farmer, it can be economically substituted for straw.

5. Mostly; but some long straw is given in racks to store cattle, with oil- or cotton-cake. The cattle eat the best of it, leaving the worst to be thrown out of the racks as litter.

6. Chaffed for sheep. The fatting cattle get a little long hay the last thing at night. The horses have straw chaff, and two trusses long hay each per week.

7. When chaffed, you can use inferior straw and fodder, making it palatable by mixing it with oil, treacle, or meal of many kinds, or with oil or cotton-cakes. Cattle eat more in quantity than when the feeding stuffs are given separately with unchaffed straw, &c.

9. Feeding times: cake and meal night and morning, with hay-chaff; roots after breakfast; hay, a little (long) last thing at night, say eight o'clock.

10. *Horses*: 2 bushels of oats, ½ bushel split beans, with two trusses hay and straw chaffed, per week per head, when in full active work. *Dairy stock*: Jersey herd kept for use of mansion only; no roots allowed; only hay, crushed oats and a little cake or bean meal. *Fatting beasts*: 6 lbs. oil-cake, 2 gallons mixed meals, ½ to 1 bushel roots, with hay chaff and a little long hay per day. *Fatting sheep*: roots, 1 lb. oil-cake, with malt dust or hay chaff daily. *Pigs*: cut roots, with beans and water for large stores, or miller's offal. *Fatting hogs*: barley meal, sometimes peas or beans mixed with the barley.

14–18. Nothing done in this way. It was carried on to some extent on a neighbouring farm, but without any great success apparently.

19. Warm water given to dairy stock in cold damp weather is no doubt good, and will greatly increase the yield of milk and cream.

Mr. MARTIN JOHN SUTTON, *of Dyson's Wood, Kidmore, Reading.*

3. Yes.

4. Peat-moss litter.

5. Yes.

6. Principally unchaffed.

7. Great saving in using straw chaffed. Hay is probably more economically used as chaff, but fattening cattle thrive better with long hay before them.

8. Waterloo round cake and linseed cake, not mixed. Tail-corn (ground) mixed with roots or chaff, or both. Swedes, mangold, cabbage, sometimes mixed and sometimes not mixed. When used with chaffed straw, generally mixed with it.

[*For Schedule of Questions, see page* 448.]

Mr. Henry Straker, *Riding Mill, Northumberland.*

3. I have used straw and chaff this year for the first time, viz., that from oats and tares, and the chaff therefrom, &c., so that not a basketful was wasted, but carefully stored as all came from the thresher. The tares were grown to feed off with sheep, but were obliged to be mown and won, for good reasons; consequently had to be used for cattle.

4. Moss-litter at 30*s.* per ton at my station. I calculate 3 cwts. serve as bedding for each beast in its loose box (cemented bottom and sides, no drains, about 8½ feet square) three weeks, with frequent turnings over, corners into middle and *vice versâ*, and then carted straight away, and laid on the grass-land at the rate of about 25 loads per acre—more if I can spare it—not a drop of liquid manure being wasted.

5. Yes, and put into oblong boxes about 16 ft. × 3 ft. × 3 ft., standing end on to and underneath two iron cylinder boilers, containing about 450 gallons each of water, which is boiled by steam; and then a mixture of 2 lbs. of bran, 1½ lb. of crushed linseed, 1½ oz. of salt, 2½ lbs. of tare meal (discontinued), per head per day, is stirred into this boiling water, left boiling for two hours, and then run off in this state over the chaff and straw, remaining so for 12 to 15 hours, and then served three times daily to the cattle, viz., at 6, 12, and 6 o'clock.

6. I do not give any hay at all.

7. Chaffing absolutely stops waste, a given quantity feeding more beasts. There is also less anxiety about fire when the cattle-man is feeding by candle-light, when he has no long straw near him.

8. Four pounds of maize meal at 10 A.M., and 3½ lbs. bean meal at 4 P.M.

10. Horses when in full work get about 5 stones of crushed oats each per week, with long hay *ad libitum*, and a bran mash, with a little boiled linseed in it, twice a week during winter weather, the oats being reduced greatly when the weather stops work.

17. Every particle of chaff off the oats and also from the tares, as well as all straw, old and new, I used up as already named. With a fixed 8 h.p. engine, chaffing of straw, crushing of oats for horses, peas, beans, cake, linseed, &c., is done, as well as the boiling of the water for the cattle "soup," all being done by the hinds from time to time as required when their horses are not at work.

18. For milking cows I think it first-rate. For fattening beasts I am not satisfied with it, as I have only sold six fat animals out of 32 which I "boxed" last November, the other 26 being still on hand. No doubt the inferiority of the tare straw, &c., which was bleached with high winds and heavy rains, to some extent accounts for their slowness in feeding; also they were put up too late, as the cattle house was under repairs, and the pastures were so bare (and not very good any part of the year, through the drought) that they lost a good deal of what "lyer" they had gained on the grass. I am not satisfied again, because the fat heifer I got fairly weighed before and after death only realised 55 per cent. of dressed meat—she was a picked one. The remaining ones are, many of them, too big-bellied; there will be too much offal; they are fairly fat big beasts, but not typical fat beasts. I tried this "soup" over chaffed *hay* with more meal, &c., in it many years ago, and the result was similar. I have a strong opinion of chaffed straw *steamed*, having either oil or treacle, with meal, &c., added while it is very hot, which answers better than giving the cattle so much sloppy food.

[*For Schedule of Questions, see page* 448.]

Mr. W. T. Scarth, *of Westside House Farm, Darlington.*

3. I use oat and barley straw and wheat chaff for pulp.

4. I use moss-litter, which costs about 30*s*. per ton, whereas straw costs about 3*l*. 10*s* per ton, and 4*l*. this year.

5. The straw is chaffed for pulping purposes.

6. Hay is given both chaffed and unchaffed; used mostly chaffed for horses and sheep, and given whole to cattle.

7. When chaffed there is less waste.

8. I use for cattle pulp containing a little salt, straw, cotton cake, meals, and turnips, and for sheep cake and oats mixed, and cut turnips.

9. (*a*) About two parts cotton to one of linseed. (*b*) Three stones of pulp in the morning, three stones of sliced turnips at noon, and three stones of pulp in the evening. (*c*) Morning, between 6 and 7; noon, 12; evening, 4 o'clock.

10. (*a*) To a *horse*, 1½ peck of corn per day, and cut hay. (*b*) To *dairy stock*, hay and cotton cake. (*c*) To *fattening beasts*, pulp containing cotton and oil cake, and ground oats. (*d*) To *breeding sheep*, a small feed of turnips a day, and a little chopped hay and a few oats. (*e*) To *fattening sheep*, oats twice per day, and cut turnips on tillage land, with a little chaff.

11. The above (No. 10) is winter feeding. In summer cattle graze in pastures, with 3 lbs. of cotton cake per head; sheep graze and get nothing else.

13. (*b*) They feed and digest their food better.

14. I have always steamed chaff and barley meal for young cattle.

15. A mixture of meal and chaff, and given cold.

16. By utilising the waste steam of a fixed engine, and also by using Barford and Perkins's steaming apparatus.

17. It keeps cattle in good health, and they thrive better.

18. For all stock except sheep.

Mr. Thomas Jennings, *Staincross, Barnsley.*

3. I have partially for a number of years.

4. I have had no need to buy, as I have always been able to grow more than I could consume in straw-yards.

5. Yes.

6. Mostly unchaffed to milch cows; chaffed and mixed to others.

7. I consider a very great economy is derived by chaffing, mixed with meal and pulped roots. Young stock especially will thrive well at a minimum cost per head.

8. Linseed and cotton-cake: two-thirds former to one-third of latter. Peas and Indian corn, with a little bran. Seconds wheat, barley, &c., for swine.

10. *Horses*: Corn, peas, maize. *Dairy stock*: Turnips, limited, twice a day; one feed of chaffed straw and meal and hay: and cake once a day. *Fattening beasts*: Turnips twice, chaffed straw and meal, and cake. *Breeding sheep*: Turnips; to graze after November; no corn or cake. *Fattening sheep*: Chopped turnips, with cake, mixed. *Pigs*: Mixed seeds, &c. &c.

11. Cattle generally have been kept well in early spring, so that the early grass with a little help has soon made them fit for butchers, so as to procure the best prices for grass beef. In winter arrangements have had to be made according to circumstances, and to the outlook of the future. Sheep in like manner.

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Mr. Thomas Jennings—continued.

13. (*a*) Chaffed food, or "lick," as it is termed here, causes both milk and butter to be sweeter and of better quality, and free from taste of turnips. (*b*) It is very useful, as it qualifies to a considerable extent the other foods given, and causes the animals to make beef more rapidly.

Professor J. P. Sheldon, *Sheen, Ashbourne, Derbyshire.*

3. On my father's farm we used a large quantity of oat straw as food for cattle, and a little for sheep, in the winter months. One way of using it was to chaff it, mix pulped turnips with it—enough of the pulp to thoroughly moisten it—and also some kind or other of meal that was cheapest and best; the chaff, after mixing, lay in a heap for twenty-four hours or so, during which time it grew warm, and the straw was thoroughly softened. Another way, chiefly with yearlings and stirks, was to put the straw out-of-doors for a few days, either to be rained on or to have water thrown on it; in this way it was thoroughly softened, and the labour of digesting it was correspondingly diminished. Cake and turnips were also fed to young cattle eating the straw —the cake broken and the turnips sliced—and they always grew remarkably well.

4. I hold to the belief that litter, generally speaking, is a superfluity and a waste, though I am aware that it is commonly used for horses, cattle, and pigs. I know from experience that pigs do not need it, if only they have boards to lie on; the same is just as perfectly true in reference to horses, if their stalls are well planned and drained. For my cows of all ages I have never used any litter at all; the stalls are smoothly paved with freestone, and there is no need whatever for litter.

5. I do not think all the straw ought to be chaffed. One feed a day, at all events, ought to consist of unchaffed straw—of straw that has beforehand been well soaked with water.

6. I seldom chaff hay except for my horses. I find that my cattle do very well with it unchaffed; and I have made some very good beef from cake and unchaffed hay. At other times I have given to fattening cattle one or two feeds a day of chaffed hay, with which one or more kinds of meal have been mixed. Cattle ruminate all the better if they eat unchaffed hay; they eat chopped hay too greedily as a rule. In any case it should be chaffed in inch or three-quarter-inch length, in order that it may demand mastication.

7. Whatever gain there is in using chaffed instead of unchaffed straw and hay consists, first, in the facility it lends to the employment of various meals, which are so readily mixed with chaff; and, second, in the moistening and softening which chaff usually receives before it is eaten. Unchaffed straw and hay may, however, be moistened and softened, and thereby much improved, inasmuch as the softening prepares it for the stomach, and makes it all the more easily digestible.

8. I use maize, rice, pea, and bean meals, always mixed with chaff that has been moistened with water. I also use a good deal of linseed and decorticated cotton-cakes. I should seldom use linseed-cake, save to cows in milk, and to yearlings, if only my cattle would eat enough of the cotton-cake. As a matter of fact, they will not eat enough of it, particularly when out at grass; and I induce them to eat more by giving them half cotton and half linseed. My land does not scour, or I should use the undecorticated cotton-cake, I think.

[*For Schedule of Questions, see page* 448.]

Professor J. P. SHELDON—continued.

9. (*a*) I generally use about four quarts of meal to each bushel of chaff, first moistening the chaff to make the meal stick to it. (*b*) I never pretend to weigh or measure the food out to the cattle, specially to fattening cattle. I give them all they will eat with a relish—all they will eat up cleanly. (*c*) The feeding hours are about 6 and 10 A.M., and 12.30, 4, and 8 P.M.

10. To *horses*, hay, hay chaff, maize, and pea meals, split beans, boiled linseed. To *cattle* the same, except the beans and the linseed, instead of which they have cakes. To *fattening beasts,* as much linseed and cotton cake as they will eat, along with hay *ad lib.*, and sometimes chaff and meals.

11. In winter as above in the stalls. In summer my feeding cattle have all the linseed and cotton cake they will eat out on the grass.

12. I do not use them. Were I a milk-selling farmer I should.

14. No. Damping the straw or chaff, as before described, is equal or superior to steaming, and much less costly and troublesome.

Mr. RICHARD STRATTON, *of The Duffryn, Newport, Monmouthshire.*

3. Yes. 4. I use moss litter when short of straw.

5. Not as a rule. I prefer to feed it long, and litter the cattle with the refuse. I only chaff in years of scarcity like the present.

6. Unchaffed generally, excepting as above, when it is cut and mixed with straw.

7. Chaffing does not pay for the labour. Cattle are far less liable to get out of health on long food.

8. I use cake and meals, generally mixing the latter with a little chaff. The kind of food varies according to prices.

9. (*a*) Nothing definite. (*b*) Varying, according to age of animal, from 2 lbs. to 12 lbs. (*c*) Morning and evening with cake and corn; morning and evening and middle-day with hay and straw.

10. I have no hard-and-fast rule, but buy what I consider cheapest.

11. Dairy cattle have only grass in summer. Fattening cattle have a little cake or meal.

12. Sometimes; I use them fresh.

13. I find no saving as a rule, but when keep is short it is sometimes of necessity to consume *all* straw and litter with moss.

Mr. J. BROCKIE, *of Golden Grove Home Farm, Carmarthenshire.*

3. Yes; for both horses and cattle, but not chaffed.

4. Plenty of straw for feeding and litter.

5. No. Have tried it, but do not approve of it. Not one of our farmers can say it is good for anything but cheating the animals by mixing the good with the bad. I let the animals pick out the best straw for feeding, and litter them with what they refuse to eat.

6. Unchaffed when given, for the reason stated above. No broken-winded horses on the farm, as they eat nothing but clean sweet fodder.

7. Unchaffed. Animals in better condition, and a great amount of labour saved. What have animals got teeth for?

8. Oil-cake and grain.

9. (*b*) Only a little, not weighed. (*c*) Morning, noon, and evening.

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Mr. J. Brockie—continued.

10. *Horses*: straw unchaffed and swedes, as much as they can eat, and 1½ bushel of oats uncrushed, and swedes uncut. *Dairy stock*: straw and hay, mangolds, and corn. *Feeding beasts*: turnips uncut, straw, and corn. *Breeding ewes*: hay, turnips, and grass. *Feeding sheep*: turnips, corn, grass, and hay.

11. Out-of-doors in the summer; in-doors in the winter. Turn out to graze in May, and turn in about November, guided by weather.

14. Have tried cooking for two winters, but shall not do so again. Stock did not do so well when turned out to graze.

Mr. T. Duckham, *Baysham Court, Ross, Herefordshire.*

3. I use all the barley and oat straw for feed, not chaffed, for cattle. Oat or wheat straw chaffed with fodder for horses. Wheat straw for litter.

4. Not any.

5. For horses only.

6. Hay, chaff, pulped roots, and meal, for fattening cattle and calves, with a little hay in the racks at night.

7. There is less waste of hay, animals consume it quicker, and the food is more readily assimilated.

8. I never separate the chaff from cavings in thrashing. My store cattle and breeding cows live exclusively on two feeds of cavings mixed with the must from cider-making during the season, followed by pulped swedes or turnips, and supped with barley or oat straw. When short of roots, or the cavings have suffered damage from rain during harvest, I apply linseed tea, boiling hot.

9. (*a*) Peck of linseed to 20 gallons of water. (*b*) As much as they will clear up. (*c*) Early morning, noon, and six in the evening.

10. *Horses*: clover or hay and straw chaff, equal parts, with crushed oats, bran, and linseed tea. *Fattening beasts*: hay, chaff, pulped roots, meal, oil-cake, and a little hay at night; oil-cake early in the morning. *Breeding sheep* run the pastures until within a few weeks of lambing, with a few turnips; before lambing they are on turnips by day, in lambing-fold at night, with an allowance of fodder. *Fattening sheep*: folded on roots; linseed cake, hay, chaff, and meal.

11. In summer fattening cattle have cake in boxes on the pastures; fattening sheep, cake and corn on clovers. In winter: Reply given in No. 10 query.

17. My breeding cows and store cattle, kept in the way described under the heading 'Mixed Foods,' are always in excellent condition and very healthy. Using the chaff with the cavings induces the latter to be all consumed in the manner described.

Mr. Robert T. Williams, *Waterloo Farm, Fromefield, Frome.*

3. I mix a small quantity with hay chaff, which I buy. I consider it improves the feed.

4. Straw for litter, which I have to buy.

5. Yes, with hay.

6. Hay, given night and morning, unchaffed; chaff as the second meal.

7. I steam the chaff; it creates an appetite, and the corn (meal) is mixed with it, and, sticking to the chaff, there is no waste. I find also that cows

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Mr. Robert T. Williams—continued.

having steamed chaff only require water once a day, whilst the others need it twice a day.

8. Oil-cake, barley meal, bran, and maize meal. The barley meal and maize meal are given alternately.

10. *Horses*: hay, and bruised oats and bran. *Cows in Milk*: 2 lbs. per day oil-cake, 1 lb. per day barley meal or maize meal, 2 lbs. per day bran, and 4 lbs. per day chaff. Hay directly after milking; chaff at 11 A.M.; oil-cake at 2 P.M., and after being out for an hour or two; hay the last meal in the evening, about 6 P.M., as much as they will eat without waste. I do not weigh this. *Swine*: Pollards and house refuse. Three days before and after farrowing they have bran; then pollards and bran, adding barley meal and milk as soon as the young begin to eat. *Fattening pigs*: one bucket of pollards, one barley meal, and one of maize meal, steamed in dairy wash.

11. In summer grass only. The previously mentioned rations are given from October to May.

13. (*a*) No opportunity yet of testing. (*b*) With regard to pigs, I should say 25 per cent. I consider them much healthier. They eat and lie down, never hunting round the sty for grit to aid digestion.

14. I steam all the food by means of a five-horse-power steam boiler.

15. Pollards, chaff (hay and straw), barley meal, maize meal. In fact, I should steam all meals for the cattle. Proportions already given.

17. A great saving of food and labour.

18. For all stock in the winter; fatting animals all the year round.

19. The cooked food is all given warm. This winter the cows at the home stannen have had warm water—that is, the chill taken off, say from 55° to 60°.

Mr. Charles Howard, *Biddenham, Bedfordshire.*

3. Yes, cut up with hay.

4. Use no substitute, but reserve enough straw for litter.

5. Yes.

6. A small portion unchaffed; the bulk chaffed.

7. In my opinion it is more economical to chaff food, as the animals cannot separate the cake flour and roots so easily from the chaff, particularly if damped somewhat more than the roots would damp it of themselves.

8. I generally boil some tail wheat or barley, as the case may be, and throw over the chaff, and then add mixed flour, linseed, and undecorticated cotton-cakes. This season, having plenty of potatoes, and being cheap, I have boiled them, and thrown them over the chaff. The bullocks have done remarkably well.

9. 5 lbs. to 6 lbs. of mixed cake, 7 lbs. to 8 lbs. of mixed flour, with the warm chaff, as above. Animals fed morning, noon, and evening.

10. *Horses*: Hay and straw chaff, oats, split beans, and maize. In summer, besides the corn, trefolium, tares, clover, and grass. *Dairy stock and fattening beasts.*—See answer to No. 8. *Breeding sheep*: A month or six weeks before and after lambing, some dry food with oats and cake; on grass, if possible, before lambing. *Fattening sheep*: roots, clover-chaff, split beans and peas, linseed and cotton-cake, oats and a little malt. *Pigs*: pollard, mixed flour, and potatoes.

11. The winter arrangements are described above. In summer the sheep are in clover, tares, trefolium, cabbages and grass, with cake and corn; cattle are on the pastures, fatting bullocks getting a portion of cake.

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Mr. Charles Howard—continued.

13. My experience is that cattle thrive much better on chaffed and mixed foods.

16. I use a forty-gallon iron furnace, in which the food is boiled as described in Answer 8.

17. Inferior chaff of hay and straw may be sweetened and made palatable, the animals doing well.

18. All kinds of cattle. 19. Yes, and with the best results.

Mr. Joseph Paget, *of Stuffynwood, Mansfield.*

3. Yes; all the oat straw and part of barley straw is eaten.

4. Wheat straw is used for litter for hunters and carriage-horses, and for thatch, and barley straw for litter for cattle. Sometimes moss litter is purchased; it is cheaper when wheat straw will sell for 3*l.* to 3*l.* 10*s.* per ton.

5. During winter a large proportion is chopped up for sheep and mixed with their corn, flour, and cake. Oat straw is also chopped up to mix with corn for cart-horses, and corn-flour or cake for cattle when milking or feeding. Barley straw is more frequently chaffed for the same purpose for store cattle, but the great bulk of straw for the cattle is eaten long.

6. Unchaffed, unless it be inferior hay, to mix with straw.

7. I have come to the conclusion that there is no advantage in chaffing straw, except to mix with other food and prevent the waste of flour, or for sheep, which waste long straw very much. The cattle leave the long straw given them in racks, like horses, and waste little. That which they do not eat serves for bedding.

8. Crushed oats or barley, mixed with decorticated cotton or linseed cake.

9. (*a* and *b*). See Answer 10. (*c*) *Milking cows*: 6.30 to 7 A.M., turnips or mangolds, after milking; 11.30 A.M. to 12 noon, cake, corn, and chop; 2.30 P.M., hay; 5 P.M., turnips or mangolds, and straw after milking. *Sheep*: cake or corn with chaff from 9 A.M. to 10 A.M.

10. *Horses*: one bushel of oats per week (except when out at grass), hay, sometimes a little bran and chopped straw. *Milking cows*: 8 lbs. of linseed or cotton cake and oat flour mixed (generally equal parts) to the best milkers; less to others, unless they are to be fed; little or none in summer when butter is cheap; 40 lbs. roots, 6 lbs. hay, 10 lbs. oat straw long, and 2 lbs. chaffed. *Feeding beasts*: 4 lbs. cake, 4 lbs. corn, 7 lbs. hay, 60 lbs. roots and oat straw, *ad lib.* *Breeding sheep*: ½ lb. maize before putting to the ram; afterwards about ½ lb. corn or cake till they lamb; then 1 lb. oats or cake till the lambs are weaned. *Feeding sheep*: from ½ lb. to 1 lb. cake and corn. *Swine*: sows in pig and stores, boiled roots and swill; feeders, 1 lb. barley meal, increased to 2 lbs. in addition, and afterwards increased to 7 lbs.

11. Lambs are put on rape as soon as clover loses its quality, in September or October; afterwards on rape and white turnips, which are drilled in alternate three rows, the latter being chopped; then on turnips only. Breeding ewes have white turnips, and then swedes, and finally mangold-wurtzel given whole on grass. Cattle begin with white turnips, then they have swedes, and finally mangolds. We do not like to give the latter to any stock before March, as they are apt to produce scouring.

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Lord ARTHUR CECIL, *of Orchardmains, Innerleithen, N.B.*

3. We feed our farm horses on straw (oat) almost entirely, though to mares getting heavy in foal, about March or April, we give a little hay.

4. We are breeding horses largely, and where the colts and brood mares can run in and out we find moss litter, at about 30*s*. per ton, better than straw. We do not like it, however, where horses have to stand constantly on it, as it draws the soles of their feet.

5. No; though we use it chaffed in our steamers. 6. Both.

7. By chaffing and mixing the chaff with oats we save nearly two bushels of corn to each pair of horses in the week, and keep our work-horses much better in health and condition. We have never, amongst upwards of 60 horses, had a case of gripes since we used the mixture (five years).

8. We boil and steam turnips, bran, cut hay, beans, and barley, and each horse, when at work, gets half an ordinary stable pailful every night, at 6 P.M. Young horses and brood mares get it twice a day, or once, according to the kind of land or pasture they may be going on to substitute grass.

9. We vary the proportions of boiling considerably, according to our observations on the dung of the horses, adding or withholding bran chiefly, which is done by the one man responsible for the health of all the horses, as he serves it out of the cooking pans. The times of feeding vary according to the time of year.

10. We give our breeding sheep nothing but hay on the hill. The lowland portion of our flock are on turnips for three hours daily from November till April, if the turnips last as long; we do not fatten any. Cows thrive well on something the same kind of boiling as the horses.

14. Yes.

15. Barley, beans, cut hay, and turnips, and mixed with bran as it comes out of the steamer. The proportions for horses require great skill and knowledge, and should depend greatly—first, on the kind of horse; secondly, on the other feeding; and thirdly, on the time of year.

16. We use a series of steamers made by Messrs. Barford and Perkins, and which are attached to a small engine, which pulps the turnips, cuts the hay, crushes corn, &c., while the steamers are working. This we find quite invaluable; but for a small scale a common boiler with a steamer on the top does very well.

17. It is the *only* way to bring out draught horses, healthily and cheaply, in the winter time. The boiling supplies the place of grass.

18. Draught horses and cows.

19. It is always done in the west of Scotland.

Mr. JOHN WATTS, *Falfield, Gloucestershire.*

3. Yes. 4. Peat moss litter; less than half. 5. Yes.

6. Unchaffed chiefly; early in the morning and last thing at night, chop being given throughout the day.

7. The economy in chaffed fodder is in some seasons very great, inasmuch as very inferior stuff might be steamed and mixed with pulped roots or other succulent food, sprinkled over with a little fenugreek, thus making a palatable mixture for store cattle; whereas, if given unchaffed, it would be attended with great waste.

9. Chaff *ad lib.*; about 100 lbs. of swedes for fatting cattle, with meal and cake; 20 lbs. to 40 lbs. ditto for stores, according to age, with a little meal or cake.

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Mr. John Watts—continued.

10. *Horses* get straw chaff, with some hay, and two bushels of crushed oats per week. *Dairy stock*: hay, if possible; if mixed with straw chaff, 2 lbs. cotton-cake per day extra; straw chaff scalded with boiling linseed tea, and pulped roots. *Fattening cattle*: as much as they can eat of chaff scalded with linseed tea, about 100 lbs. of swedes, 4 lbs. of meal, and 4 lbs. of cake. *Breeding sheep*: roots and hay. *Fatting sheep*: ditto, with corn and cake, about ½ lb. each. *Swine*: grass run as long as possible, with a little dry corn. *Fatting pigs*: pulped roots and grain, with barley, wheat, and other offal corn, ground.

11. In summer most of the cattle, horses, sheep, and pigs are out at grass—except calves under a year old. In winter all are brought to the yards that room can be found for; some remain out all the winter, having a shed to go in—a plan which might be practised to advantage.

12. Not more than can possibly be helped, and then for pigs only, having generally a fair supply of roots or cabbages.

13. If dairy cattle are in loose boxes or open yards they often waste a great deal of hay, if unchaffed; but if they are tied up and have proper feeding mangers they are very contented with unchaffed hay, and thrive quite as well, saving the labour and expense of cutting and mixing. Fatting cattle would be better fed with chaffed and mixed food, to get them to eat as much as possible.

14. For years our practice has been to steam the chaff used for every kind of horned cattle and horses, with boiling linseed tea thrown over the chaff required for twelve hours' consumption. The chaff is well mixed up and the steam confined, which in a very short time ferments and gives the whole mixture a very sweet-smelling flavour which the stock very much relish. To this is added the allowance of roots and meal for the respective classes of cattle to be fed.

15. For fattening cattle, two-thirds hay to one of straw; for store cattle and horses, all straw, should hay be in limited supply, as is the case this year.

17. That good use may be made of both hay and straw which might have been damaged by weather during harvest.

18. To all kinds eating hay and straw.

19. Always to very young cattle; quite agree to it for old ones.

Mr. F. R. Moore, *Littlecott, Upavon, Wilts.*

3. Cut into chaff, mixed with hay; say one-third straw and two-thirds hay.

4. Wheat straw for litter; barley or oat straw for cutting into chaff.

5. Yes.

6. All hay is chaffed, either with or without straw, which is a great saving, and doubly pays for the extra labour.

7. Hay will go much further; sheep will eat it up cleaner, and lie down and rest afterwards.

8. Best linseed-cake, old English beans, meal, pollard, malt dust.

9. (*b*) Half lb. per day for stock things. (*c*) Morning and night for fatting sheep; morning for stock.

10. *Breeding sheep*: cut hay with little straw, small quantity of roots. *Fattening sheep*: cake and beans, with a little meal, two or three times a day, with cut roots, cut hay, and uncut hay; also a little green food.

12. Brewers' grains are very good for breeding ewes if procurable daily.

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Mr. SANDERS SPENCER, *St. Ives, Hunts.*

3. Yes; chaffed, and mixed with a very few pulped roots, cotton-cake and cocoanut meals.

4. For the cattle the litter from the piggeries is used.

5. Yes.

6. A portion chaffed with the straw, the remainder given long.

7. A considerable saving in quantity used, and greatly increased facility in the admixture of other foods.

8. Principally foreign products, including foreign grain.

10. *Horses*: oats and maize. *Dairy stock*: roots, cotton-cake, and cocoanut meals, mixed with hay and straw chaff. *Pigs*: bran, sharps, English and foreign wheat and barley (ground), beans, maize, cocoanut meal, cotton-cake meal, roots, green clover and lucerne, growing grass, &c.

14. I have only attempted with pigs.

17. None; but a considerable loss.

18. Not for pigs.

19. I have found the mixing of the pigs' food with warm in place of cold water result in great benefit, especially with young pigs and sows suckling.

Mr. ROBERT TURNBULL, *The Mount, Wolverhampton.*

3. Yes. Oat-straw and hay are chaffed and mixed with pulped swedes. Barley-straw is sold to mattress-makers unless it contains a good proportion of clover. Barley-straw is never given to cows in milk, as it tends to 'dry' them. Barley-straw may with advantage be given to cows that are difficult to 'dry,' but it should be chaffed and mixed with hay-chaff and a little boiled linseed. Cattle largely fed on oat-straw are usually afflicted with lice.

4. When straw is not plentiful the horse-manure and bedding is spread daily on the meadows, and the straw, after a drying wind, is raked up, and is used for bedding young stock. The oftener straw is dried the further it goes as bedding. When straw is dear the cows have sparred floors—$1\frac{1}{2} \times 3\frac{1}{2}$ spars resting on $4 \times 5\frac{1}{2}$ supports. In-calf cows and cows in milk are always liberally bedded, however dear straw may be. When sparred floors are used the bedding goes as far again, and the cows are much more easily kept clean than when they stand on a flagged or boarded floor bedded in the usual way.

5. Yes, to some extent to cows in milk and for feeding cattle. In-calf cows and heifers and young stock get long oat-straw at night and for the first foddering in the morning. The rough leavings are used for bedding. Wheat-straw is always chaffed for cattle. It is a good plan to chaff wheat-straw a few months before it is required, and to mix 1 cwt. of pulped roots with 1 ton of straw. Green clover may be mixed with the first thrashings of straw in the autumn—a thick layer of straw and a thin layer of clover. The clover improves the flavour of the straw.

6. For cows in milk, two-thirds hay and one-third oat-straw are chaffed and mixed with pulped roots when roots are plentiful, otherwise with boiled linseed, crushed oats, and Indian corn, for all fodderings except the first in the morning and the last at night, when the best long hay is given. Cows are liable to lose their cud unless they get at least one foddering a day of long hay. When hay and straw are good in quality, neither are chaffed for young stock or in-calf cows and heifers, unless roots are scarce, in which case straw and hay are chopped and mixed with roots for two fodderings.

7. Cows with defective teeth, and young stock when they are getting their teeth, eat chaffed food more readily than long hay and straw. When

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Mr. Robert Turnbull—continued.

straw and hay are inferior in quality through long exposure in harvesting, the quality can be raised to the right standard by the admixture of meal and linseed. Some cattle will well-nigh starve rather than eat inferior hay and straw unchaffed and unmixed with meal or roots. Hay and straw, when harvested very dry, are more readily digested after being chaffed and mixed with roots or linseed, and allowed to stand 24 hours before being fed to the stock.

8. Linseed-cake, crushed; pea-meal; the Driffield Company's undecorticated cotton-cake; malt culms; crushed oats; bean-meal; cotton-cake in the early summer months, and when roots are plentiful; linseed-cake when grass is scarce; bean-meal in preference to cotton-cake when beans are cheap. My experience of cotton-cake is that it helps to make butter firm, but when fed regularly to cows it weakens their breeding powers. Sweet skim milk: when cattle are in low condition skim milk and cod-liver oil are amongst the best restoratives. Treacle to dairy cows for a week before and after calving.

9. The proportion of each description of food must be regulated by the weather and the end in view. A liberal supply of carrots in severe weather. Cows: in winter, 5.30 A.M., long hay; 6, linseed-cake; 8, chaff, pulped roots, &c.; 11, ditto; 3 P.M., ditto; 5, long hay.

10. *Horses*: clover, hay, carrots, crushed oats, bran, and 1 lb. of linseed-cake daily to cart-horses, wheat-straw, oat-straw. *Dairy stock*: clover and meadow hay, linseed-cake, oats, bran, Indian corn, carrots, swedes, golden tankard mangold, cabbages, tares, pea-meal, oat-straw (if well got, not otherwise). *Fattening cattle*: winter-sliced swedes, oat-straw and hay chaffed and mixed with meal, long hay at night. Fat cattle thrive better on sliced roots than when fed on pulped roots; sliced roots appear to cause a better flow of saliva than pulped food, and as stalled cattle get no exercise this is a very important consideration. The sweet juice of swedes appears to agree better with fat cattle than pulped roots that are slightly fermented. Fat cattle, after eating sliced roots, rest and sleep more contentedly than after a meal of pulped food. *Sheep*: white turnips in the early winter, then swedes, hay and pea-meal, malt culms and cake, the proportion depending on the weather. *Swine*: boiled potatoes and barley-meal.

11. Constant change of pasture. I prefer to stock heavily early in the season, and to graze cattle not under two at May-day that have good coats and are fully 50 per cent. carcass weight to begin with. I prefer cattle to have never been housed or in a covered yard, and cattle never to have tasted artificial food. Cattle reared on milk, grass, and hay, I find graze better than cattle raised in the turnip and straw districts. No cattle graze better than Cumberland bullocks, which are usually fed on grass in summer and on hay of prime quality in winter. Rock salt should be placed in every pasture. In very hot weather, when flies are about, both fat cattle and dairy cattle should be put in cool yards in the heat of the day, and should be supplied with tares, ryegrass, clover, lucerne, &c. I always like to have a ryegrass pasture in May and June, to put young cattle and calves in when old pastures have a scouring effect. Ryegrass is much safer than cotton-cake for young stock.

12. No. I keep pastures well eaten down, believing that grass contains more nutriment when it first springs than at any other stage of growth. Pastures are cleared for a fortnight at a time, or longer in dry weather. Stocked at May-day, after the first month they are rarely grazed more than a fortnight together. I attach great importance to a constant supply of pure

[*For Schedule of Questions, see page* 448.]

Mr. Robert Turnbull—continued.

soft water, and to frequent change of pasture, especially where sheep are concerned. I prefer seeds for sheep to old pasture; white clover when the land is strong and rich.

13. When hay and straw are chaffed there is less waste when the quality is second rate. Hay, if at all mouldy, should not be given to breeding stock in any form, or to young stock. It should be steamed as well as chaffed, and given to strong store bullocks. When roots are given to cows sliced the milk tastes strongly of the roots, but if the roots are pulped and mixed with chaffed hay and straw, and allowed to stand twenty-four hours without being fed, the milk is not unfavourably affected, no matter whether fed before or after milking. As before stated, I prefer sliced roots for fattening cattle, but if hay and straw have been much exposed in harvesting, chaffing and pulping must be resorted to.

14. Not as a rule. I believe steamed food to be the best for cattle that have weak digestions and for newly-calved cows that are heavy milkers, or that have defective teeth. I would not buy cattle for summer grazing on any account that had been fed on steamed food in covered yards.

15. Hay, meal, bran. Bran and hay tea are excellent for newly-calved deep-milking cows.

16. Barford and Perkins, of Peterborough, have given special attention to this matter. The waste steam from an engine can be economically used in steaming hay by turning it through a false floor.

17. I believe that by giving newly-calved cows food in the most digestible form the risk of milk fever is greatly reduced; and that in the case of cattle with defective teeth, the food consumed is more readily digested. When plenty of poultry and pigs are kept there is little actual waste of food, as the manure, if thinly spread on the manure heap, is carefully picked over.

18. Aged cows, newly-calved cows, cattle that have defective teeth, cattle that have weak digestions.

19. I have found that cows milk more abundantly when the chill is taken off the water in cold weather.

Mr. Clare Sewell Read, *Honingham Thorpe, Norwich.*

3. Yes.

4. I have two covered yards, and so economise the litter for bedding cattle.

5. All the oat-straw is chaffed, and some of the best barley-straw; cut with steam power and trodden into old barns and a little salt added, and occasionally a small quantity of vetches, clover, or grass, but sometimes this addition causes mould or too much heat.

6. All the hay save that used for the riding stable is chaffed.

7. You cannot get the cattle to eat a large quantity of long straw, and by mixing pulp or shredded roots with the chaff they will eat any quantity, and so you give the necessary bulk of food at a little cost, and can keep more stock upon your farm.

8. The lean cattle have only roots and straw chaff. The fat stock and cows in milk have hay and straw chaff, and such roots, cake, meal, and malt as you allow them.

9. Apportion the roots and artificial food to the different kinds of stock, and allow them to eat as much chaff as they please; they are fed three times a day. Crushed malt will sweeten a large quantity of dry unpalatable chaff.

10. *Cart-horses* are fed with hay-chaff (a little straw and corn-chaff added), crushed oats, and a few roots in winter; in summer, crushed oats and chaffed lucerne. *Fattening beasts*: in winter—roots (all cut into fingers or shreds), hay and straw-chaff, linseed and decorticated cotton-cake, meal,

[*For Schedule of Questions, see page* 448.]

Mr. Clare Sewell Read—continued.

and malt. *Dairy stock*: much the same, only the cows go out for grass and white turnips on the pastures, and have mostly cotton-cake. *Ewes* have to run over stubbles and grass in winter, and pick up the turnips after the fat sheep, and eat straw-chaff until lambing, when they have better food. *Fat sheep* have whole turnips and swedes, hay-chaff, cake, malt, and corn.

11. The cart-horses are kept in the yards all the year round. Dairy stock are housed at night in winter, running out whenever the weather permits; have always cotton-cake in summer. I hardly ever have any fat beasts in summer, and the young stock are sent down to grass marshes by Yarmouth.

12. No. (A record of the way in which grains are stored round about Burton will be found in our Report of the Prize Farms at the Derby (1881) Show.)[1]

13. The first year I commenced farming on my own account my cart-horses had the 'strangles,' and I allowed them all the long hay they liked. They ate and spoiled so much in three months that I have never used any long hay since.

Mr. John Speir, *Newton, Glasgow.*

3. Cows in full milk get from 8 lbs. to 10 lbs. of fresh oat-straw uncut; dry cows as much as they care to eat.

4. My litter is principally composed of thatch from grain stacks, potato or carrot pits, &c., straw being too easily sold here to be allowed to be simply trodden under foot to make manure. I have tried moss in the byres by nailing a two-inch spar along the edge of the gutter at the cow's heels, and filling it in front with moss. The body of moss was, however, too thin, and the cows kicked it largely into the gutters. It was, therefore, discontinued as being too costly.

5. No.

6. Generally unchaffed, unless it is wished to boil or steam it in order to mix it with meals.

7. Chaffing has no advantages unless it is wished to mix it with meal or cake, or for the purpose of using up hay which would in great part not be eaten alone owing to bad quality.

8. Silage, oat-straw, hay, cabbages, cut clover, tares, in season, all as grown, and unchaffed. Brewers' or distillers' grains, mutton pea meal (dall of India), decorticated cotton-seed-cake in meal, refuse maize-meal from the starch manufactories, linseed-cake, bean-meal, malt-sprouts, &c., all mixed in whole or part with brewers' grains.

9.

Present daily ration up to April 4, 1888	Dry matter	Starch	Albuminoids	Oil
8 lbs. oat-straw	6·53	3·2	·11	·05
10 lbs. silage (grass)	3·0	1·1	·2	·06
14 lbs. potatoes	3·5	2·9	·29	·02
10 lbs. grains	2·2	1·08	·39	·08
½ lb. linseed-cake (American)	·4	·08	·07	·03
4 lbs. mutton peas	3·3	2·0	·8	·05
2½ lbs. refuse maize-meal	2·2	1·5	·4	·13
	21·13	11·86	2·26	·42

[1] See Vol. XVII. (2nd Series), Part II., page 462.

[*For Schedule of Questions, see page* 448.]

Mr. John Speir—continued.

Ration after this week (April 4, 1888)	Dry matter	Starch	Albuminoids	Oil
8 lbs. oat-straw	6·53	3·2	·11	·05
20 lbs. silage	6·0	2·2	·4	·12
10 lbs. grains.	2·2	1·0	·4	·08
½ lb. linseed-cake	·4	·08	·07	·03
4 lbs. mutton peas	3·3	2 0	·8	·05
2½ lbs. refuse maize-meal	2·2	1·5	·4	·13
	20·6	9·98	2·18	·46

Cake is given during milking in the morning (4 A.M.); grains and meals 6 A.M., 12 A.M., and 6 P.M.; silage, mid-forenoon; potatoes, mid-afternoon; also straw, 10 A.M., 4 P.M. and 6.15 P.M. Stock, Ayrshires, 8 to 8½ cwt.

10. *Horses*: 16 lbs. bruised oats, 4 lbs. maize broken, 12 lbs. to 14 lbs. hay, one-fourth of which is cut and mixed with the grain, the remainder given long. *Dairy stock*: see No. 9.

11. Dairy stock: concentrated food as given under No. 9 for all winter, which is occasionally altered according to the price of the different materials. The green food used in early autumn is spring tares, or second cut Italian or clover; then the sprouts of early cut cabbages sold for table use. From about October 20 to November 30 carrot leaves are alone used, and very good they are. Cow cabbages fill up the time till the new year, with Italian and clover second cut made into silage after. Diseased potatoes are largely used during October and part of November, and to the extent of from 14 lbs. to 21 lbs. daily from the new year until now (April). In summer, in addition to pasture, each cow gets about 7 lbs. grains and 4 lbs. of decorticated cotton-cake meal, and 3 lbs. of oat-straw or hay, and an equivalent of cut grass. They are in the house all night.

12. I use brewers' grains all the year to the extent of one-fifth to one-third bushel to each cow, according to season and price. I can generally get them fresh, and prefer them in that state, even although a little dearer, to preserved ones. I have preserved them several years in houses like a silo, covered with sods, but have had better results when fresh ones were used.

13. Where all the produce is of such a quality as will be cleanly eaten separately, I see no gain and no economy in chaffing, but there is needless labour.

14. All meals are boiled by steam for between one and two hours before use, the mixture being given sloppy and warm. So much water is given in the green food and along with the steamed meals that it is rarely a cow in full milk takes a drink of water. They are generally offered such for a few days after calving, bnt at other times, unless a month just now, they never take it, although offered it.

15. The pea and maize meal shown in No. 9, which see.

16. I am partial to a small upright boiler with or without tubes. Such raises steam quickly, is cheap, and easy of attention; egg end boilers take more coals to raise steam than an upright one to raise and supply it. For steaming meal and heating water I use ordinary farm boilers (cast-iron), set in a row against the wall, built firmly in with cement, a pipe going down the one side. The boilers are emptied with shovels or buckets.

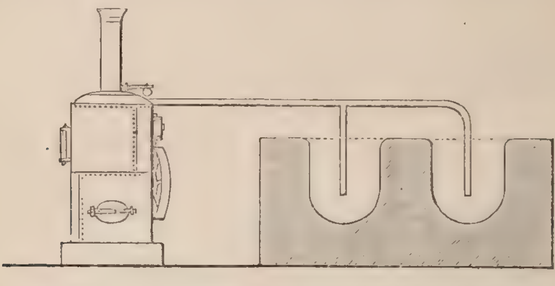
17. The very best possible results.

[*For Schedule of Questions, see page* 448.]

Mr. John Speir—continued.

18. For cows in full milk only, or with a slight modification for store in-calf cows. My experience does not go further.

19. I feel quite convinced that the most cannot be made out of either cows or food unless they are kept warm, and their food and drink are given



warm. This applies particularly to cows in full milk. So much is this the case that even with very comfortable quarters every night's frost will lower the production of milk from 2 up to 10 or 12 per cent., which immediately returns with the mild weather. A single drink of cold water will often cause congestion in the udder, and always lowers the milk yield.

Mr. Hunter Pringle, *Eastmere, Watton, Norfolk.*

3. Yes. I use for feeding purposes three-quarters of the straw I grow. I do so in the firm belief that straw, when properly treated, is valuable food, that by using as much as possible for food I can keep a maximum of stock, and therefore have a maximum of manure (both quantity and quality), and have a maximum of profit from stock. The system of open yards is a great flaw in English husbandry. I calculate the loss entailed by waste of valuable feeding straw in England amounts to a tax of 7*s*. per acre on the arable land throughout the country.

4. My cattle are partly tied up, on a system which renders litter straw almost unnecessary. The platforms on which they stand are formed of concrete, laid off in V-groove bricks. The platform is 6½ feet long, with a slope of one inch to the foot. Behind the bullock is a small sunk gutter, into which the solid manure drops. The liquid from heifers falls direct into this gutter; with bullocks the V-grooves carry it at once into the gutter. In order to make the best manure in every place, the rough manure from four horses is shaken up, the fæces are thrown upon the manure heap (under roof), and the straw spread below the tied-up cattle. The straw from four horses beds eight beasts. In my covered yards waste, wet, or soiled straw, weeds, thatch straw, or any useless material is used as litter. I find we use fully twelve of food straw to one of litter.

5. I chaff all my straw. Were I to litter my tied-up beasts with straw other than what comes from the stables, I would have it all chaffed. Cattle do not pull chaffed litter into rolls or lumps, consequently the bed is always even. Where a Maynard is used, the riddlings or dressings should be used for litter and the short lengths for food. I consider the chaffing of straw absolutely necessary if the greatest profit and the least waste is to be derived from cattle or stock-feeding or management.

[*For Schedule of Questions, see page* 448.]

Mr. HUNTER PRINGLE—continued.

6. As hay is a severe crop on our poor light lands, I do not make much. I always have a little, but the acreage under hay is the lowest possible. I chaff it all. My work horses are allowed some during times of extra hard work; at other times they get only oat straw. I may say that on this farm four horses, each pair working a double furrow plough, have to plough, seed, and work 60 acres of land for roots and 125 for corn. The work is always well done, and the horses are always fat and fresh.

7. In my opinion, and from my experience, I am led to conclude that the advantage to be gained from chaffing is only felt when the pulping of roots and the mixing of stock food is also carried out. Stock, *i.e.* store cattle, fed on straw of sound quality, do equally well on long straw, but they pull out and waste a great deal, and they select the best and decline the worst. Chaffing prevents this, of course, but mixing is the great means of having everything eaten up.

8. Ensilage, cut straw, pulped potatoes, pulped roots (turnips, swedes, and mangolds). Always given mixed, and the mixture always of the same age. I never allow any variation in the length of time the food lies in heap. During autumn I allow the mixture to soak one full day; in spring the roots are drier, so the heap lies for two days undisturbed.

9. One lot of cattle (A) gets per head per day 2½ stones silage, 2 stones pulped potatoes, 2 stones pulped mangolds, 15 lbs. cut straw, 3 lbs. cake to begin with, 6 lbs. cake to finish with; these cattle drink no water. Another lot (B) get per head per day 2½ stones silage, 4 stones pulped mangolds, 15 lbs. cut straw, cake as before; these cattle drink no water. Store cattle get 2 stones pulped mangolds, 1½ stone silage, 10 lbs. cut straw, 2 lbs. cake; these cattle drink a little water, but not much. Hours of feeding: half cake first in the morning; an hour afterwards half mixture; at 2 P.M., half mixture; 6 P.M., half cake.

10. *Horses*: A mixture of pulped roots, cut straw, and at times cut hay, with one stone apiece of silage through the mixture. *Breeding ewes*: Only grass until one month before lambing, when 10 lbs. to 14 lbs. of roots are allowed (never swedes); when on roots, cut straw and hay, or oat chaff, is always given. If there is a lot of rough pasture, the ewes run there during the day and on the turnip fold during the night. After lambing, and when all danger of fever and inflammation has gone, I feed as liberally as possible, never forgetting dry food and a little bran, cake, and oats. When grass is plentiful in summer I give no other food.

11. This being a light land farm, I keep mostly a sheep stock. Cattle are not suited for summering here; the grass grows too short, and the soil is too hot for cattle. During autumn, winter, and spring I treat cattle on the system already explained. At the same time I always have a few young beasts during summer; these I run thinly with the sheep for the benefit of the pasture. The cattle eat down the rough herbage refused by the sheep, and coarseness in the pastures is thereby avoided or prevented.

13. I bought a lot of cattle on December 13, 1887, at 10*l.* Yesterday [March 19] I sold half of them at 18*l.* 10*s.*; the others are worth 17*l.* 10*s.* The cost of food as described under letters A and B, I calculate, amounts to 8½*d.* per day. No charge is put upon straw, but no credit is taken for manure. Roots are valued at 10*s.* per ton, silage at 10*s.* per ton, and cake at 1*d.* per lb. On the old system, roots *ad libitum*, and long straw and hay, I calculate the cost would be half again as much, and not such rapid fattening.

14. No. I highly approve of steaming chaff, but do not think cooking roots beneficial. A trial made some years ago did not please me.

[*For Schedule of Questions, see page* 448.]

Mr. Wm. Stratton, *Kingston Deverell, Warminster.*

3. Yes. 4. Damaged straw. 5. No. 6. Unchaffed.

7. I consider it bad economy to chaff, and I never use a chaff-cutter.

8. Whatever description of corn or cake can be bought or kept back from market to best advantage at the time.

9. Various, depending upon the kind of stock.

Mr. John Treadwell, *Upper Winchendon, Aylesbury.*

3. Yes. 4. Use straw for litter.

5. Some is, and mixed with hay; some is used whole.

6. Both mixed and chaffed if you have some that is not so good. You can get stock to eat it better; and mixed with other things it becomes more palatable.

7. There is less waste, and it enables you to mix the best and worst hay together, which, with meal or cake in addition, makes it more profitably used. I think, in giving dry stock whole straw, they will reject the worst and eat the best, thus doing better than if they were made to eat all alike. Of course, they require cake or meal with straw, or they will not thrive well enough, or make the manure good enough.

8. American linseed cake and decorticated cake, often mixed. Meal is made of about one-ninth malt, two-ninths wheat, two-ninths maize, two-ninths Indian peas, and two-ninths barley this year. Of course this varies according to the price of different articles; but I always use from one-eighth to one-tenth malt for everything—cattle, sheep, pigs, or horses. I believe that it is better than any condiment; it keeps stock healthy and assists to digest and assimilate their food. What surprises me is that farmers do not use it more generally; I have used it for years for all kinds of stock.

9. (*a* and *b*.) Answered in Nos. 8 and 10. (*c*) Morning and afternoon. Hay first and last; roots, meal, cake, and chaff given about 8 to 9 A.M. and 3 to 4 P.M.

10. I keep my *cart-horses* on hay and straw chaff, with an allowance of 1 bushel ground maize, ½ bushel oats, and ½ peck of crushed malt per week. *Breeding dairy cows* get 10 lbs. mixed meal per day in hay and straw chaff, with long hay *ad libitum*. *Fattening dairy cows* get 5 lbs. mixed linseed and decorticated cotton-cake, and 5 lbs. up to 10 lbs. of mixed meal, with mixed chaff and long hay, with two-thirds of a bushel of sliced mangolds, per day. *Fattening beasts* get the larger allowance of meal as well as the roots and cake. The dairy cows are fatted off after their third calf, or previously if bad milkers. In the summer mixed linseed and cotton cake is usually given with the grass, about 5 lbs. to the breeding cows whilst in milk; the fatting dairy cows get about the same allowance of cake and meal as in winter, with a little chaff, only they do not eat quite so much meal, 5 lbs. meal and 5 lbs. cake being about the maximum. *Sheep* are fed according to circumstances. *Swine* have what meal they will eat when fattening; same mixture as cattle.

13. I find that I can keep many more cows by feeding in this way, that my grass land very much improves, that my cows milk well, holding their milk for a great length of time, and when killed fat the butcher gets an extra quarter in their loose fat, as they generally die remarkably well, often turning out 15 to 20 stone (of 8 lbs.) of loose fat.

[*For Schedule of Questions, see page* 448.]

Mr. HENRY WOODS, *Merton*, *Thetford*, *Norfolk*.

3. Yes; oat straw.

4. German moss litter is used extensively as well as straw; the former is found too cold for pigs in winter, but answers well for horses, cattle, and large stock. I consider the moss much cheaper than straw; 1 ton of the former (including all expenses) costs 45*s.*, and is equal to 1½ ton of wheat straw, value 60*s.*

5 and 6. For horses, and also for cows, &c., when mixed with other food such as pulped roots. Otherwise it is given long, like hay.

7. The chaffing system prevents the food being consumed too hastily, avoids waste of food, and promotes digestion. It prepares the diet also in a more concentrated form, and helps the use of less palatable food by the process of fermentation, which, with the additional aid of spices or condiments, will convert poor or sour edibles into wholesome nutriment.

8. None in general use.

10. *Horses*: One and a half gallon oats and hay chaff, 1 stone long hay, occasionally 2 lbs. or 3 lbs. linseed cake. *Dairy stock*: 3 lbs. linseed cake, 1 gallon crushed oats and bran, and 1 stone long hay or oat straw; also 28 lbs. drumhead cabbage, occasionally 1 stone parsnips. *Fattening beasts*: 6 lbs. to 8 lbs. linseed cake, 1 gallon crushed beans or peas, hay, and cabbages. *Breeding sheep*: Ground oats and bran, or cake, and cabbages or swedes. *Fattening sheep*: Ground or crushed peas or maize, cake (linseed), hay, or cabbages. *Swine*: Barley meal and bran, skim milk and refuse vegetables, &c., acorns.

11. In summer dairy cattle and young cattle get a few pounds of linseed cake on the pastures, and the sheep later on when the pastures begin to fail. Cart-horses are turned out to graze for two or three weeks between hay-time and harvest. In October cows come in at night, and are put on half winter diet. The sheep remain out on extra food (cake, oats, or hay) when required; at the end of November the winter system of feeding commences.

12. No. Not selling milk, we prefer less watery food, and use malt culms in preference. The latter, however, have now been abandoned, being hardly considered equal to good bran, and we intend giving desiccated grains a trial if possible.

13. We rely chiefly on concentrated diets containing a high albuminoid ratio, 1 : 6 or 7, in order to increase the proportion of butter to milk. The practice with regard to fattening (No. 10) has a similar object, in increasing animal fat so far as it is allied with health and quality of produce.

14. Only during the cold months for pigs, which receive their usual food warmed up in a large copper heated by a stove beneath.

16. I have found the following the best and most simple, of which a rough sketch is appended (see next page). The stove is situated in a corner of the meal-house, and the chimney is carried through the roof.

The building and making of this stove cost 2*l.* 7*s.* 6*d.*, with the exception of the chimney pot, which had been placed there by a former tenant. The copper is worth about 5*s.* Total, 2*l.* 12*s.* 6*d.* It has been up about three years, and has repaid its cost handsomely.

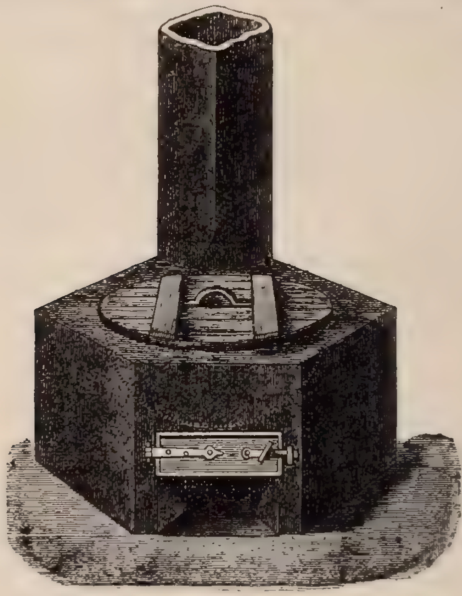
18. For all cattle, dairy stock, and pigs during the cold season. The outlay in coal or coke is very trifling, and the larger amount of food cooked, and increased size of copper, will reduce this expense proportionately. The copper should never be empty when the stove is ignited, otherwise it may crack; a gallon or two of water will prevent this mishap. Any food may

[*For Schedule of Questions, see page* 448.]

Mr. Henry Woods—continued.

be cooked in this way, and the water will boil in a few minutes. A large fire, however, should not be made unless there is sufficient food to pay for it.

19. Yes; a very good plan. Iced water has a decidedly injurious effect



if indulged in too frequently. The water should not be warmed higher than 55° or 56° Fahrenheit (ordinary summer or autumn temperature).

Mr. H. J. Sheldon, *Brailes House, Shipston-on-Stour, Warwickshire.*

3. Yes, when I have roots to pulp and mix with it; but this winter (1887) have used only long straw for things to pick over and eat as much as they would, and used the remainder for litter.

6. Chiefly unchaffed.

7. The expense of chaff-cutting, even by steam, is heavy, and, unless for the purpose of mixing with pulped roots, too great to be incurred.

10. *Horses*: Oat straw, hay, oats. Beach of all kinds, hay and straw. *Breeding sheep*: Clover hay. *Fattening sheep*: Clover hay, oats, oilcake, peas, and a very few roots. *Swine*: Barley meal and sharps.

Mr. George Wright, *Cranmore, Shepton Mallet, Somersetshire.*

3. It is all chaffed and consumed.

4. I endeavour to cut a little fern for cows to calve on; at other times they have no bedding whatever.

[*For Schedule of Questions, see page* 448.]

Mr. GEORGE WRIGHT—continued.

5. Yes. 6. Whole.

7. Straw is most economically given chaffed, and inferior hay too, as much would certainly be wasted: but best hay, given whole, I find eaten up clean.

8 and 9. Grain. (*a*) 2 bushels of chaff to ½ peck of grains; (*b*) 4 bushels of chaff and 1 peck of grains, and they pick a little grass when turned out; (*c*) 6 A.M. and 4 P.M.; stock are turned out from 10 A.M. to 3 P.M. for exercise, excepting in very rough weather.

10. *Horses*: One peck of oats daily, cut chaff, and a little whole hay. *Dairy stock*: In winter 4 bushels chaff, 1 peck grain, 4 lbs. cotton-cake; in summer months only grass. *Fattening sheep*: 1 lb. mixed cotton and linseed cake daily, and green food *ad. lib.* *Swine*: Whey and barley meal for fatting pigs; grain and wash for breeding ditto.

11. Generally speaking, most of the cows are dry in winter, and are kept out; some half are in milk, and are fed as per former replies.

12. They are had fresh every week.

13. (*a*) I find a great saving in chaffed food for consuming straw and inferior hay, and cattle thrive better on a little mixture than on only one kind of food. (*b*) Do not fat.

Mr. T. H. HUTCHINSON, *Catterick, Yorkshire.*

3. Yes; all the best straw.

4. Inferior straw and moss litter. Moss litter I consider excellent for cow-houses and for drying up liquid manure.

5. Yes. 6. Mostly chaffed.

7. Less waste; the food is more palatable; cattle fill themselves quicker, consequently have more time to rest and put on flesh. A mixture of pulped turnips and chaff does not reduce the temperature of the animal's body so much as a large feed of sliced turnips does, and heat is equivalent to food. When pulp is mixed with straw, the latter is softened by the juice in the turnip, and is made much more digestible.

8. Pulped turnips mixed with chaff and chaffed straw; linseed cake and meal.

9. (*a*) The pulp and chaff mixture depends upon my root crop; if I have plenty of turnips I use more in the mixture. (*b*) What each beast will eat without waste. (*c*) 6 A.M., 8 A.M., 11 A.M., 3 P.M., and 7 P.M.

10. *Horses*: Chaffed oat straw, ground oats, bran, a few roots, and 1 lb. linseed cake. *Stock*: Pulped turnips, steamed food one meal, a few sliced roots, and a little cake. *Sheep*: Turnips, grass, hay, oats, bran, malt combs, &c. *Pigs*: Offal corn, ground; sometimes with boiled potatoes.

11. In summer cattle graze in the pastures, getting cake if required for the butcher. In winter they are housed and fed as above described.

13. By using pulp, chaff, &c., I think you can feed 20 per cent. more cattle, and they will thrive better.

14. Having a steaming apparatus fixed to use waste steam from my engine, I can steam food at little expense, so I generally cook a large steamer full daily for milking cows. The mixture is composed of boiled linseed, crushed oats, malt combs, bran, pea or bean-meal, and chaffed hay. When I have roots to pulp and mix with chaffed straw I do not consider I gain by steaming, excepting that I like to give milk cows one good feed per day of the cooked food. In feeding cattle much depends upon having proper

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Mr. T. H. Hutchinson—continued.

machinery, buildings, and convenient arrangements. Messrs. Barford and Perkins make the best steaming pans I have seen.

17. I have benefited to the extent of keeping about 20 per cent. more stock. The food being given in a more palatable form, cattle have thriven better, and I have less illness.

18. For all cattle I recommend pulp and chaff, but for milk cows and fattening cattle I would give one feed per day of turnips put through a slicer or finger cutter, and give meal along with the turnips. I do not recommend mixing meal with pulp and chaff long before it is used.

19. Yes, with milk cows, and I think you undoubtedly get more milk.

Mr. Gilbert Murray, *Elvaston, Derby.*

3. All the straw is chaffed, mixed with meal of various kinds, and fed to horses, cattle, and sheep.

4. For every description of stock, except carriage horses and hunters in work. Moss litter only is used, the cost of which is 32*s*. per ton, as against 80*s*. per ton for wheat-straw. I consider 1 ton of moss litter equal to 30 cwt. of straw. For dairy cows and young stock it is much more wholesome; it is a first-rate absorbent, and keeps the sheds perfectly sweet.

5. Yes.

6. One of hay to two of straw is the usual proportion; the whole is chaffed; scarcely any long hay is used.

7. There is great economy in chaffing. With ordinary attention there is no waste; the mangers are swept out after each meal; the leavings from any of the milking cows are given to the dry stock. Long hay cannot, under the most careful management, be used without considerable waste.

8. The following is the mixture of foods which I use: oats, wheat, white peas, linseed. These are all ground together; at present prices the cost is under 7*s*. per cwt. I think the albuminoid and carbohydrate ration cannot be improved.

9. Oats, 1 cwt.; wheat, 1 cwt.; white peas, ½ cwt.; linseed, ¼ cwt. To a cow in full milk the allowance is 6 lbs. to 8 lbs. per day.

10. *Young horses* have 6 lbs. to 8 lbs. per day of the mixed meals, as above, with cut chaff (hay and straw); the meal and chaff are mixed together and saturated with water twelve to twenty-four hours before being used. *Dairy cows* are fed in the same way. The *fattening beasts* have 4 lbs. of meal and 4 lbs. of linseed-cake, with cut chaff, and 28 lbs. of pulped roots per day. *Breeding sheep* have 1 lb. of the mixed meal per head per day with chaff, and a few roots spread about the pastures. *Fattening sheep* have 1 lb. per head daily of best linseed-cake and cut swedes. *Swine* are fattened on whey, skim milk, or butter milk, with barley and pea-meal.

11. For fattening beasts, 4 lbs. to 6 lbs. of a mixture of linseed and cotton-cakes are used on the pastures during the last six weeks before going to the butcher. The dairy cows in full milk, and the calves and yearlings, have an allowance of mixed meals throughout the summer. I find the mixed meal answers admirably for young growing stock.

12. Brewers' grains are of low nutritive value; they contain a large percentage of water, which during the winter months must be raised to the temperature of the body at the expense of a considerable waste of carbohydrates. The effect of brewers' grains on the yield of milk is chiefly due to the quantity of water held in suspension. The same object can be

[*For Schedule of Questions, see page* 448.]

Mr. Gilbert Murray—continued.

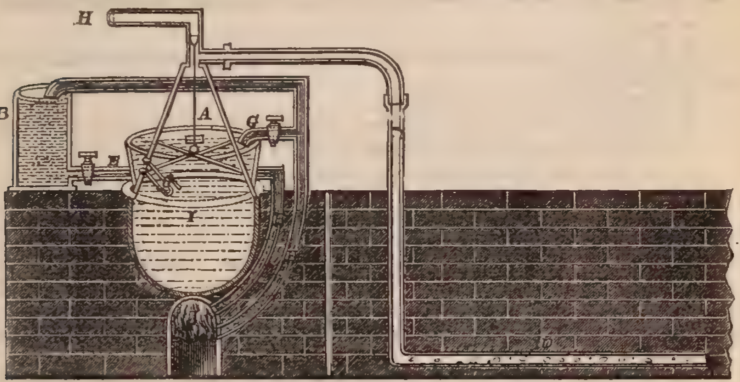
obtained by the addition of water to the chaff and mixed meals, and be effected at much less cost.

13. Foods, when skilfully compounded, prevent the waste of nutritive matter. Stock thrive well on the mixture. The component parts of the food are varied to suit the object in view, whether this be milk, butter, or cheese, or the growing or fattening of young stock.

14. The chaff and meal is mixed in the desired proportions, placed in a brick or wooden cistern having a perforated bottom lining. Beneath this the steam is admitted from the boiler of a steam-engine, or from steam generated in an ordinary metal furnace, over which is placed a tin or zinc dome.

15. Chaff, roots, and meal, the proportions of which vary according to the kind of stock to be fed. For dairy cows in full milk the proportion of meal to chaff is one of the former to six of the latter.

16. Where a steam-engine is used for the various operations required for the preparation of food for a large herd of stock, the surplus or waste steam from the boiler is certainly the cheapest means of cooking the food. On small occupations, or on farms where chaff-cutting and other operations are effected by a hired engine, we have improvised a simple and efficient method of cooking by means of the system shown in the accompanying sketch.



AA, tin or zinc dome fitting into the furnace-pan or copper. So long as the water in the pan remains above the lower end of the cone or top no steam can escape except through the steam pipe. BB, tank for supplying the boiler with water. C, the feed pipe. The supply of water is regulated by a brass tap as shown in sketch. D, brick cistern containing the food to be cooked. The perforated pipe is carried near the false bottom to a chamber into which it is distributed and from which it gradually permeates the mass contained in the cistern. The top is covered by a closely fitting lid, which prevents any escape of steam. The chaff and meal should be well saturated with clean water when placed in the cistern. E, the feed pipe from the water cistern. This pipe is carried under the pan, when it comes into direct contact with the fire and thus acts as a superheater. The heated water rises through the return pipe F, and is discharged into the boiler at G. I, the pan or copper, which may be of any size, from 10 to 120 gallons. The size will depend on the amount of work it is expected to perform. Sufficient food has been

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Mr. Gilbert Murray—continued.

cooked during the winter months to satisfy the requirements of 40 head of cattle and horses with a 25-gallon pan. J, the fire for heating the pan, which is set with a flue all round. This insures the greatest economy from the quantity of fuel used.

17. It is a mistake to suppose that the food is rendered more nutritive by cooking. Nevertheless there is considerable economy, as the food is more easily digested. The waste, both of flesh-formers and heat and fat producers, is lessened. In the case of ruminants, coarse food has frequently to be re-masticated three or four times before it becomes in a fit state to pass to the second stomach, and the secretion of saliva cannot be effected without a certain expenditure of food.

18. I have successfully used cooked food for every description of farm-stock, more particularly for dairy cows. Cooked food, when given in a moist or semi-liquid state, takes the place of roots or brewers' grains, and produces the same result at a greatly reduced cost.

19. In the case of winter dairying the flow of milk is increased, and a certain economy of food effected, by giving the food at a temperature of 60° to 70° Fahrenheit.

Mr. William Janes, *Hunter's Farm, Leavesden, Watford, Herts.*

3. Yes.

4. I use for litter the refuse of straw and such as is not sweet and good enough for feeding.

5. Yes; cut with one-third hay.

6. Principally chaffed, but a proportion unchaffed, for both beast and sheep.

7. Both cattle and sheep eat them better in chaff without waste.

8. Linseed and cotton-cake, with meal made from thin barley unfit for malting, ground with a mixture of lentils or Indian peas.

9. (*a*) Equal quantities. (*b*) Sheep, 1 lb. per day; beasts, 2 years old, 7 lbs. per day. (*c*) Morning and night.

10. *Horses*: straw, chaff, and oats and maize. *Dairy stock*: linseed and cotton-cake, grains, and chaff. *Fat beasts*: linseed and cotton-cake, meal, chaff and hay, and roots. *Ewes*: grass, mixed chaff, and oats. *Fat sheep*: linseed and cotton-cake, chaff, hay and turnips. *Pigs*: barley and pea-meal, and whole peas.

11. Beasts in summer have some linseed and cotton-cake in boxes in the fields—one to each animal. Beasts in winter are in yards, or tied up in sheds. Sheep in winter are on turnip land, and have cake, chaff, and hay night and morning.

12. I use brewers' grains fetched direct from the brewery twice each week.

13. Both cattle and sheep do better with a mixed food, eating it better, and not getting sick or cloyed, as they will by feeding them altogether on one kind of food.

14. I boil linseed, and pour it whilst hot over the straw and hay chaff, and let it remain one day before using.

15. Linseed or refuse small wheat, or any kind of offal seed.

16. I simply boil mine in a copper about four hours, but farmers who have a steam-engine can steam their chaff in a closed bin cheaper and with less trouble.

17. All the stock eat it well, but at present prices it does not pay.

18. For feeding or dairy stock. Calves, ewes, and lambs—in fact, all stock—like it.

These replies, as was to be expected, show a great variation in practice, this variation being as a rule controlled by local custom, and the actual resources of the farm.

Chaffing.—Taking the first subject, the answers show a general consensus of opinion in favour of chaffing foods. Of the whole of the replies, no less than 70 per cent. show chaffing to be adopted, while in 20 per cent. more it is partially adopted, and in 10 per cent. only is the answer in the negative. The further answers on this question are of the greatest interest, showing as they do how much straw is now used for feeding, only the rough being used for bedding, and where this is also used for food, moss litter is the usual substitute. No less than 46 per cent. of my correspondents use this substitute, and as a rule the remainder either have sufficient straw both for feeding and litter, or else use the rough for the latter purpose. Over the whole of the replies in which prices are given there is a saving of 55 per cent. in the cost of moss litter as compared with the value of straw. In one case the very bold opinion is put forward that litter is not required for any description of stock. This opinion is expressed by Professor J. P. Sheldon, a gentleman farming in the bleak peak district of Derbyshire, the last district from which we should expect to hear that "litter, speaking generally, is a superfluity and a waste." All the replies to questions 3 to 7, as given by Professor Sheldon, are well worthy of careful attention (see page 452). On the whole question, there is a general agreement as to the usefulness and economy of chaffing foods. The latter comes chiefly from the avoidance of waste, and the great facility it gives for moistening and mixing with various meals. Another point which is really of great importance is brought out in the very valuable reply by Mr. Henry Straker (page 450), where he says that "there is also less anxiety about fire when the cattle-man is feeding by candle-light, when he has no long straw near him." On the other hand there are some influential opinions against chaffing. Whatever is said by such experienced men as the Strattons deserves attention. Mr. Richard Stratton, of The Duffryn, Newport (Mon.), believes that "chaffing does not pay for the labour, and that cattle are less liable to get out of health on long food" (see page 453). But it is a curious commentary on this opinion, especially when taken in conjunction with the practice and opinion of such a large number of other feeders, that *in years of scarcity* the food is here given chaffed. Unless this is because of the greater economy of the practice, it is impossible to imagine the reason. Mr. William Stratton, another good farmer, considers it bad economy to chaff, and never uses a chaff-cutter (see page 466).

These two opinions are, in reality, the only pronounced ones against the economy and usefulness of chaffing, for that given by Mr. H. J. Sheldon is more conditional than pronounced.

On the whole, therefore, the opinions are in favour of the system, and may well be summed up in the carefully expressed answer by Mr. Henry Woods, of Merton (page 467). "The chaffing system," he says, "prevents the food being consumed too hastily, avoids waste of food, and promotes digestion. It prepares the diet also in a more concentrated form, and helps the use of less palatable food by the process of fermentation, which, with the additional aid of spices or condiments, will convert poor or sour edibles into wholesome nutriment." The opinions, also, of Mr. C. S. Read (page 461) and Mr. Gilbert Murray (page 470) may also be referred to as putting very well the claims for chaffing foods.

Mixed Foods.—The replies are entirely favourable to this practice, but it is impossible to evolve any very general rules as to what the mixture should be. In this matter the feeder must be ruled by what he has, or what he can best and most cheaply obtain. The various experiences given in the replies will, however, be of value as giving a good guide in cases where similar foods are the best obtainable. The reader must refer to the answers for the actual practice on the several farms described. It can only be said in a general summary that the use of food-mixtures has become very general on most of the good farms of the country, and that the use of meals, chiefly of corn, is becoming more and more common. This results generally from the low prices which have of late prevailed in our markets.

Cooked and Steamed Foods.—So far as the economy and usefulness of cooked or steamed foods are concerned, there is the greatest variety of opinion, but on the whole it must be said that there is not so much in favour of the system as there is in favour of chaffing and mixing foods. Sir John Lawes has very kindly sent me a short summary giving the results of experiments on the subject, in which he says:—

"While the various methods of preparing fodder for animals, such as steaming, ensilage, &c. &c., may be accompanied by practical advantage, all the experiments hitherto executed show that the *digestibility* is not sensibly increased. It was found by Hellriegel and Lucanus, that the digestibility of rye-straw by sheep, was not increased either by fermenting or cooking it. Experiments in Proskau by Funke gave the same results regarding the digestibility of the total dry matter and the cellulose of a mixed ration, fed to milk cows.

"Recent experiments at Popplesdorf showed decreased digestibility of hay as a result of steaming. Coarse hay fed to oxen, first dry, then steamed, showed a reduced digestibility of all the constituents, but especially of the

protein, which was reduced from 46 per cent. to 30. Boiled bran given to oxen was less digestible than dry bran. The digestibility of concentrated fodder is not increased by cooking."

In the face of such pronounced results as the above it cannot be claimed for these systems that they make the foods themselves more valuable. At the same time, as Sir John Lawes points out, they may have practical advantages, such as the avoidance of waste by making the most of the foods so prepared and by the more thorough incorporation of the various mixtures employed. Thus Mr. Henry Straker finds that with hot food treacle can be added and mixed more readily. In several cases, reference is made to the value of steaming as restoring damaged hay and making it more palatable eating for stock. For aged cattle with defective teeth, and young stock, there may be considerable advantage also.

Opinions are however not favourable for its use for stock which require hardiness, and several correspondents give a very decided opinion that animals that have been fed with cooked or steamed foods in covered yards do badly afterwards when grazing.

For the purposes indicated, much also depends on the cooking and steaming being done cheaply and simply, and descriptions of some very good apparatus have been sent by certain of my correspondents. Three of these are of a character that may be adopted on any farm possessing a steam boiler. Where this is not the case, Messrs. Barford and Perkins's apparatus may be usefully employed.

But it cannot be too strongly pointed out, that in no other branch of this enquiry is it so clearly shown that the advantages are clearly bounded by definite lines. Neither cooking nor steaming can be recommended beyond very small limits, and each feeder must really be the judge as to whether in his case any advantage can be gained. No less than 65 per cent. of my correspondents in this enquiry either have no opinion to offer on the subject or are opposed to the system, and only in 35 per cent. of the instances is the practice adopted.

These are the lessons brought out in the enquiry. That they are of value cannot be doubted. Good feeding consists of making the best use of the foods available, or most cheaply obtainable, under given circumstances. Speaking broadly, chaffing straw and hay, and giving these foods as a portion of a mixture (meals of corn and cake and pulped roots being most usually added) may be generally adopted with advantage. Cooking and steaming cannot be so generally recommended. The value of these operations is clearly limited, and—in the case of hardy animals—may be non-existent. Under some

circumstances, foods may be more easily mixed, while in others they may be improved. But no rule can be formulated applicable to all circumstances.

XXIV.—*Feeding Experiments conducted at Crawley Mill Farm, Woburn, in the Winter of* 1887–8. By Dr. J. AUGUSTUS VOELCKER, B.A., B.Sc., &c., Consulting Chemist to the Society.

A.—*Sheep-feeding Experiments.*

THESE experiments were in continuation of those made in the two previous years, with the object of throwing light on the profitable use of cereals as additional food for sheep feeding off swedes on the land. The sheep were, as before, of the Hampshire and Oxfordshire cross, 10 months old, and 40 in number, divided into 5 pens of 8 sheep each. The foods selected for trial were as follows:—

PEN I. received Oats (crushed).
PEN II. " Barley (grittled).
PEN III. " Oats and barley, in equal quantities.
PEN IV. " Wheat (whole).
PEN V. " Oats and wheat, in equal quantities.

In each pen the sheep received as many sliced swedes as they would eat, and also hay-chaff, the quantities of both being weighed out to them.

The experiment began on December 19, 1887, and lasted until April 9, 1888, a period of 16 weeks (112 days). For the first week ½ lb. of the additional foods was given per head daily, but after that it was increased to ¾ lb., remaining at this until the close of the experiment. Analyses of average samples of the foods taken from time to time were as follows:—

—	Crushed Oats	Grittled Barley	Oats and Barley	Wheat	Oats and Wheat	Swedes	Hay chaff
Moisture	12·50	16·79	15·15	18·70	15·28	88·25	15·23
Oil	6·30	2·10	4·81	1·97	5·00	—	—
[1] Albuminous compounds	13·06	9·87	12·87	9·49	13·06	1·32	9·00
Starch, digestible fibre, &c.	57·17	65·76	58·14	66·18	55·68	9·01	68·85
Woody fibre	7·87	2·74	6·53	1·87	6·74	·78	
Mineral matter	3·10	2·74	2·50	1·79	4·24	·64	6·92
	100·00	100·00	100·00	100·00	100·00	100·00	100·00
[1] Containing nitrogen	2·09	1·58	2.06	1·52	2·09	0·21	1·44

The costs of the additional foods were, including cost of crushing :—

		s.	*d.*
Oats (weight per bushel, 42 lbs.) . . .		23	6 per 336 lbs.
Barley („ „ 56 „) . . .		27	0 „ 448 lbs.
Wheat („ „ 60 „) . . .		29	0 „ 480 lbs.

The weights of the sheep at commencement were :—

WEIGHTS OF SHEEP PUT UNDER EXPERIMENT ON DECEMBER 19, 1887.

—	Pen I.	Pen II.	Pen III.	Pen IV.	Pen V.
	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.
	1 0 7$\frac{3}{4}$	0 3 14$\frac{1}{2}$	0 3 17$\frac{3}{4}$	1 0 13$\frac{1}{2}$	1 0 10$\frac{1}{2}$
	1 0 8$\frac{1}{4}$	1 0 15$\frac{1}{2}$	1 0 0	1 0 1$\frac{1}{2}$	1 0 10$\frac{1}{2}$
	1 0 12$\frac{1}{2}$	1 0 15$\frac{1}{4}$	1 0 4	0 3 25	1 0 5
	1 0 15$\frac{1}{2}$	1 0 10	1 0 19	1 0 15	1 0 2$\frac{3}{4}$
	1 0 8	0 3 22	1 0 22	1 0 0	1 0 8$\frac{1}{4}$
	0 3 17$\frac{1}{4}$	1 0 21$\frac{1}{4}$	1 0 7	1 0 5	1 0 4
	1 0 22$\frac{3}{4}$	1 0 12$\frac{3}{4}$	1 0 1	1 0 16$\frac{1}{2}$	1 0 16
	0 3 25	1 0 8	1 0 11	1 0 4$\frac{1}{4}$	1 0 5
Total of 8 sheep	8 2 5	8 2 7$\frac{1}{4}$	8 1 25$\frac{3}{4}$	8 1 24$\frac{3}{4}$	8 2 6

The sheep were daily given a first feed of sliced swedes at 7 A.M., corn and hay between 10 and 11 A.M., and a second feed of swedes at 4 P.M. The average amounts of food consumed during the whole period by the sheep per head daily were :—

—	Pen I.	Pen II.	Pen III.	Pen IV.	Pen V.
	lbs.	lbs.	lbs.	lbs.	lbs.
Swedes	20	19$\frac{1}{2}$	19$\frac{2}{3}$	20	16$\frac{3}{4}$
Hay chaff	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
Oats	$\frac{3}{4}$	—	$\frac{3}{8}$	—	$\frac{3}{8}$
Barley	—	$\frac{3}{4}$	$\frac{3}{8}$	—	—
Wheat	—	—	—	$\frac{3}{4}$	$\frac{3}{8}$

During the winter, which was a very open one, the sheep fed capitally and kept well, with one exception. This was a sheep in pen 5 (wheat and oats), which died on January 24, after shifting the pens from one field to another. The sheep was examined by a veterinary surgeon. It was found to be very fat around the kidneys, but there was no undue quantity of wheat or oats in the stomach, these with the other foods being all well digested. It is not unusual, I believe, for sheep to die after shifting from one field to another, from the consequent excitement and partaking, it may be too freely, of the fresh food

just afterwards. This seemed to be the case here. The animal on December 19 had weighed 1 cwt. 4 lbs., and on January 24 the carcase weighed 9 stones (of 8 lbs.).

The weights at the conclusion of the experiment were:—

WEIGHTS OF THE FIVE PENS OF SHEEP AT THE END OF 112 DAYS, Dec. 19, 1887, to April 9, 1888.

——	Pen I.	Pen II.	Pen III.	Pen IV.	Pen V.
——	Oats	Barley	Oats and barley	Wheat	Oats and wheat
	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.
Weights of Sheep	1 2 0	1 0 25	1 1 4	1 2 6	1 2 3
	1 1 20	1 2 7	1 1 22	1 2 1	1 1 15
	1 1 25	1 1 25	1 1 13	1 1 20	1 1 12
	1 2 8	1 2 8	1 2 22	1 1 25	1 1 14
	1 1 25	1 1 2	1 2 16	1 1 24	1 1 27
	1 2 0	1 2 10	1 1 24	1 1 22	died Jan. 24.
	1 3 2	1 2 11	1 1 23	1 2 14	1 1 20
	1 0 25	1 2 5	1 2 6	1 1 22	1 2 9
Total weight of sheep, April 9, 1888	11 3 21	11 3 9	11 3 18	11 3 22	10 0 16
Total weight on Dec. 19, 1887.	8 2 5	8 2 7¼	8 1 25¾	8 1 24¾	7 2 2
Total increase in weight of sheep during 112 days	3 1 16	3 1 1¾	3 1 20¼	3 1 25¼	2 2 14[1]
Equivalent in lbs.	380 lbs.	365¾ lbs.	384¼ lbs.	389¼ lbs.	294 lbs.[1]
Increase per head during the whole period .	47 lb. 8 oz.	45 lb. 10 oz.	48 lb.	48 lb. 10 oz.	42 lb.
Daily increase per head	6·8 oz.	6·5 oz.	6·9 oz.	7 oz.	6 oz.

[1] 7 sheep only.

These results show in the case of four of the five foods comparatively small differences in the increase of live weight. The actually highest result was got with wheat, but both oats and oats-with-barley nearly approached it, whilst barley given alone showed a less favourable result, and wheat-with-oats the lowest of all. It would appear that between foods so nearly approaching one another in chemical composition as these, the differences in live weight obtained are likely to be but small, but that the mixture of oats and wheat is not so suitable, whilst as to the rest, barley given alone is hardly as good a food as the others. As regards wheat, the experiment proves, I think now beyond

doubt, that this may be both safely and profitably used for feeding sheep off on roots. For the third year in succession wheat has been tried, and each time has shown very good results.

I was careful in this experiment not to disturb the sheep by more frequent weighings than were necessary, and the experiment was allowed to proceed throughout with one weighing at the commencement and one at the end only. The more I see of experiments, the more I am convinced of the undesirability of frequent weighings. As an instance of this I may note that owing to the difficulty of disposing locally of so many sheep at one time, they were sent off in two batches, one half (four from each pen) on April 9, the other half on April 16. On re-weighing after the week's interval, the same feeding being continued, the remaining sheep in each of the pens were found, with one exception, to have lost weight, as follows :—

			lbs.
PEN I. (4 sheep)	. . . .	loss	12
PEN II. „	. . . .	„	14
PEN III. „	. . . .	gain	3
PEN IV. „	. . . .	loss	27
PEN V. (3 sheep)	. . . .	„	12

For those interested in the question of live and dead weights, I append the following statistics. All the sheep were weighed

——	Date	Live weight	Date	Fasted weight	Date	Carcase weight in 8lb. stones	Average fasted weight per sheep in 14lb. stones	Average carcase weight per sheep in 8lb. stones
		cwt. qrs. lbs.		cwt. qrs. lbs. = 14lb. st. st. lbs.		st. lbs.	st. lbs.	st. lbs.
en I. (4 sheep . Oats)	Apr. 9	5 3 25	Apr. 10	5 2 0 = 44 0	Apr. 11	41 3	10 13	10 3
(4 „ .	„ 16	5 3 12	„ 17	5 1 20 = 43 6	„ 18	41 5		
Pen II. (4 sheep Barley)	Apr. 9	5 1 0	Apr. 10	5 1 0 = 42 0	Apr. 11	39 1	10 11	10 1¼
(4 „	„ 16	5 3 14	„ 17	5 2 3 = 44 3	„ 18	42 1		
en III. (Oats & Barley) 4 sheep	Apr. 9	5 3 5	Apr. 10	5 2 0 = 44 0	Apr. 11	40 4	11 1¼	10 3½
4 „	„ 16	6 0 16	„ 17	5 2 10 = 44 10	„ 18	43 0		
Pen IV. (4 sheep Wheat)	Apr. 9	5 3 24	Apr. 10	5 1 16 = 43 2	Apr. 11	40 3	10 9¼	10 ¼
(4 „	„ 16	5 2 27	„ 17	5 1 2 = 42 2	„ 18	40 7		
'en V. (Oats & Wheat) 4 sheep	Apr. 9	5 2 16	Apr. 10	5 0 24 = 41 10	Apr. 11	39 3	10 8¾	10 0¾
3 „	„ 16	4 1 16	„ 17	4 0 7 = 32 7	„ 18	31 3		

'ercentage of offal (including whole wool).	Pen I.	Pen II.	Pen III.	Pen IV.	Pen V.
	45·75	46·19	46·21	45·56	45·71

on the morning of April 9, and twenty of them (4 from each pen) were then sent on their journey, their destination being Nottingham. They were kept fasting and weighed again in the market on the morning of April 10; they were then killed and the carcase weights recorded on the next day. Mr. Fraser, the resident manager at Woburn, personally superintended the whole of the operations from beginning to end, so that the figures given may be accepted as absolutely correct. The remainder of the sheep continued to feed as before till April 16, when they were weighed and sent off to Nottingham for slaughter, just like the others, Mr. Fraser again personally seeing to the accurate recording of the results.

Here it should be mentioned that in consequence of the cold weather the sheep were not shorn before being killed, so that the live weights and also offal include the whole wool.

As to the meat, the purchaser's remarks were to the effect that the quality of it was in every way excellent. The "ripest" mutton was however that from Pen I. (oats), although that from the oats-with-barley and the wheat-fed sheep was also very ripe.

Next to be taken into consideration are: the expense of the additional foods, and their relative cost in producing the increase in live weight.

			£.	s.	d.	Relative cost in additional food per lb. of increase in live weight. d.
Pen I.	658 lbs. Oats (crushed)	cost	2	6	0	1·45
Pen II.	" " Barley (grittled)	"	1	19	8	1·30
Pen III.	329 " Oats / " " Barley	"	2	2	10	1·34
Pen IV.	658 " Wheat (whole)	"	1	19	8	1·22
Pen V.	329 " Oats / " " Wheat	"	2	2	10	1·51

The differences in manurial value and in chemical composition of the foods are so slight as to make it unnecessary to enter into calculations of them.

The wheat, it will be noticed, produced the most increase at the lowest cost per lb. of increase. The increase of weight in all the pens was very satisfactory, and somewhat similar to the results obtained in the first year of the experiments, the wheat (as then) producing one pound of increase at the lowest cost. Oats-with-barley was the only other food alike in the two sets of experiments, and the results in the two cases are nearly the same.

B.—*Bullock-feeding Experiments.*

In addition to the sheep-feeding experiments it was determined to institute some on bullock-feeding, with the view of seeing how far home-grown food could be utilised, and how it would compare with cake. There was accommodation in the farm buildings for sixteen bullocks, viz. eight in the feeding-boxes, four in a covered shed, and four in an open yard. The bullocks were three-year-old Herefords purchased at Northampton market. The plan was to have three comparative experiments as follows:—

a. Bullocks to receive daily per head	3 lbs. Linseed cake, 3 lbs. Decorticated cotton cake and 3lbs. Maize meal.	in addition to Swedes and Hay.
b. „	3 lbs. Bean meal, 3 lbs. Oats, 3 lbs. Barley.	
c. „	3 lbs. Wheat, 3 lbs. Oats, 3 lbs. Barley.	

The wheat was in this case given grittled and not whole, the oats and barley crushed.

In the feeding-boxes were placed four bullocks receiving food as in (*a*), and four having food as in (*b*). In the covered shed were two more fed as in (*b*), (making six in all to this set), and two fed as in (*c*), whilst the remaining four in the yard were also fed like the last-named. The amounts of swedes and of hay were altered according as the bullocks would take more or less, but the weights of these consumed were recorded, as also of the water drunk.

The analyses of the various foods were:—

Analyses of Foods consumed by Bullocks.

—	Decortd. Cotton Cake	Linseed Cake	Maize Meal	Beans	Grittled Wheat	Barley and Oats	Swedes	Hay-chaff	Straw-chaff
Moisture . . .	9·28	11·73	12·67	18·49	16·76	Same as in sheep-feeding experiments, page 476.	88·95	20·19	15·69
Oil	10·47	12·41	4·07	1·47	1·84		—	—	—
[1] Albuminous compounds	39·81	25·62	9·44	21·94	8·68		1·27	10·44	4·24
Mucilage, starch, digestible fibre, &c.	27·44	34·12	70·50	47·54	68·86		8·36	62·16	74·52
Woody fibre . .	4·97	8·93	1·63	7·87	1·77		·86		
Mineral matter .	8·03	7·19	1·69	2·69	2·09		·56	7·21	5·55
	100·00	100·00	100·00	100·00	100·00	—	100·00	100·00	100·00
[1] Containing nitrogen	6·37	4·10	1·51	3·51	1·39	—	·20	1·67	·68

The respective costs of the foods were, including cost of delivery, cartage, breaking, &c. :—

	£	s.	d.	
Linseed-cake (at 8*l.* per ton delivered to nearest station)	8	4	0	per ton
Decorticated cotton-cake (at 6*l.* per ton, 10*s.* carriage)	6	14	10	„
Maize-meal (at 26*s.* per quarter = 480 lbs.)	1	8	3	per 480 lbs.
Oats (at 20*s.* 6*d.* per quarter = 336 lbs.)	1	3	6	per 336 lbs.
Beans (at 36*s.* per quarter = 504 lbs.)	1	18	3	per 504 lbs.
Barley (at 25*s.* per quarter = 448 lbs., home-grown)	1	7	0	per 448 lbs.
Wheat (at 29*s.* per quarter = 480 lbs.)	1	9	0	per 480 lbs.

As the four bullocks fed on cake and meal (*a*) were in the same building and under precisely the same conditions as the four others fed on beans, oats, and barley (*b*), it is better to regard this as one experiment, although there were altogether six fed on food *b*. The comparison is further a better one since these eight bullocks were sent off together to be slaughtered, and their fasted and carcase weights were recorded at the same time. The experiment began on December 19, when all the bullocks were weighed and put up, and it continued until April 9, a period of 112 days. The bullocks in the boxes began by eating about 38 lbs. of swedes per head daily, 4 lbs. of straw-chaff and 6 lbs. of hay, and they drank about 22 lbs. of water. They soon took more hay, viz. 7 lbs. daily, and drank more water, 35–45 lbs., the quantity of roots also increasing to 40 lbs. After this the amounts of roots, hay, and chaff taken did not increase, and the animals fed steadily on. During the whole period the weights of food consumed were :—

	By 4 bullocks fed on linseed-cake, decorticated cotton-cake, and maize-meal, during 112 days.			Average per head daily.	By 4 bullocks fed on beans, oats, and barley during 112 days.			Average per head daily.
	cwt.	qrs.	lbs.	lbs.	cwt.	qrs.	lbs.	lbs.
Swedes	159	2	16	39·9	158	1	6	39·5
Straw-chaff	16	3	22	4·2	16	0	26	4·1
Hay	27	1	18	6·85	27	3	6	6·9
Cake or Meal	36	0	18	9	36	0	18	9
Water	172	1	10	43·1	143	2	0	35·9

On April 9 the bullocks were weighed at the farm, then sent off, like the sheep in the previously recorded experiment, to Nottingham, they being fasted meanwhile. The fasted weights were taken in the market on April 10, the beasts slaughtered, and the carcase weights taken on the next day. Mr. Fraser was present all the time, and took every possible care to ensure accurate records being obtained.

Meanwhile two more bullocks had been feeding in the covered shed on the food *b* (beans, oats, and barley), and two

on the food *c* (wheat, oats, and barley), while in the open yard were four also taking the food *c*. The four in the boxes did very well, but not so those in the open yard, for among them ringworm broke out, one beast suffering in particular. This made them rather low, and they did not all feed well. While in this condition two of them, Nos. 14 and 16, were attacked on February 12 by an illness, the nature of which could not be found out. They lingered for a considerable time, refused their food, and appeared to be in great pain. On February 20 the first one (No. 16) died, and the local veterinary surgeon not being able to state the cause of death, parts of the animal were sent to the Royal Veterinary College for examination by Prof. Wortley Axe. Some long time had, however, elapsed before they could be examined, and they were then too stale. Prof. Axe himself visited the farm on February 22, and ordered the second bullock to be carefully watched, and should it die parts of it to be at once sent to him. The poor beast suffered greatly, so much so indeed that the humane feelings of the attendant induced him on February 29 to give it relief from its pain by a friendly blow, and the necessary parts were forwarded for investigation as before. It may be mentioned that it was feared that anthrax had broken out, but whether this was the case could not be ascertained, for it transpired that the humane blow struck had prevented the appearance of the very organisms which would have been recognisable in the case of anthrax had the animal been allowed to die naturally. Thus the outbreak, whatever it was, was not traced to its cause. Whether the food was unsuited to the animals or not is also uncertain; under ordinary circumstances the best thing to do would probably have been to change the food, but this was not possible in an experiment. The remaining bullocks fed on to the end, were weighed on April 9, and again on April 16, when, like the sheep, they were found to have lost weight. Accordingly calculations are based on the weights taken on April 9, when, we may say, all three experiments closed. These remaining bullocks were treated just like the first lot, viz., weighed on the farm on April 16, fasted, weighed again in Nottingham market on the morning of the 17th, then slaughtered, and the carcases weighed on the following day.

It may be here observed that while the cake-fed bullocks ate up their cake and meal quickly and then lay down, the two other lots took their supply less quickly, but made two feeds of it, lying down between times. The general plan of feeding was 20 lbs. of roots, 4½ lbs. of cake or meal, and 2 lbs. of straw, the

first thing in the morning; at 10 A.M. 4 lbs. of hay, and at 4.30 P.M. roots, straw, cake, and corn, as in the early morning.

The amounts of food consumed by the 4 bullocks in division *c* during the period were :—

	By Bullocks feeding on Wheat, Oats, and Barley. cwt.	qr.	lbs.	Average per Head Daily. lbs.
Swedes	159	2	16	39·9
Straw-chaff	16	0	2	4
Hay	27	3	14	6·97
Meal	36	0	18	9
Water	114	2	0	28·5

In the appended tables, on page 485, are given the full particulars as to the increase in weight, the live weights at farm, fasted weights, and carcase weights, of all the 14 animals that went through the experiments.

For the purpose of comparison, it will be noticed that the two bullocks in the yard did just about as well as the two in the shed having the same food, and these four animals may accordingly be taken together, as representing the increase on the diet of wheat, oats, and barley. It is true that the two single animals fed on beans in the shed appear to have done better than the four in the boxes, but the comparison with four animals is a much safer one than with two only, and hence the four on beans in the boxes are taken by preference as representing the gain due to the beans, oats, and barley mixture, the conditions here being exactly similar to those in the case of the cake-fed animals.

We come thus to the conclusions :—

—	Fed on linseed-cake, decorticated cotton-cake and maize-meal	Fed on beans, oats, and barley	Fed on wheat, oats, and barley
	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.
Increase in live weight of 4 bullocks, feeding 112 days	10 2 13	9 1 16	8 2 13
Equivalent in lbs.	1189 lbs.	1052 lbs.	965 lbs.
Gain per head daily	2·65 lbs.	2·35 lbs.	2·15 lbs.

On calculating the composition of the entire mixed food given to the animals in each experiment, the "albuminoid ratios" were found to be as follows:—Cake-fed Bullocks, 1 : 4·8; Bean-fed Bullocks, 1 : 6·33; Wheat-fed Bullocks, 1 : 7·65.

Weights of Bullocks, 1887–8.

Number	Weight at commencement, Dec. 19, 1887	Unfasted weights: On April 9, 1888	Unfasted weights: On April 16, 1888	Increase in live weight during 112 days ended April 9, 1888	Fasted live weights in cwts., qrs. and lbs.	and also in stones of 14 lbs.	Carcase weight in 8 lb. stones
I. Four Bullocks fed on Linseed-Cake, Decorticated Cotton-Cake, and Maize-Meal (in Boxes).					(April 10)		
	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.	st. lb.	st. lbs.
1	11 2 7	14 2 0	—	2 3 21	13 2 0	108 0	108 7
2	9 1 14	11 2 13	—	2 0 27	10 2 20	85 6	89 1
3	8 3 22	11 3 2	—	2 3 8	10 3 0	86 0	88 4
4	10 1 7	12 3 20	—	2 2 13	11 3 24	95 10	99 0
Total of 4 bullocks	40 0 22	50 3 7	—	10 2 13	46 3 16	375 2	385 4 or 58·73 p. c.
II. Four Bullocks fed on Beans, Oats, and Barley (in Boxes).							
5	9 3 18	12 0 20	—	2 1 2	11 1 14	91 0	93 2
6	9 1 25	11 2 27	—	2 1 2	11 0 21	89 7	93 6
7	9 3 14	12 0 14	—	2 1 0	11 1 14	91 0	94 0
8	11 0 8	13 2 20	—	2 2 12	12 2 0	100 0	103 6
Total of 4 bullocks	40 1 9	49 2 25	—	9 1 16	46 1 21	371 7	384 6 or 59·19 p. c.
III. Two Bullocks fed on Beans, Oats, and Barley (in Covered Shed).					(April 17)		
9	9 0 7	12 0 0	11 3 17	2 3 21	11 0 4	88 4	87 3
10	10 3 0	13 1 23	13 1 27	2 2 23	12 2 8	100 8	102 3
Total of 2 bullocks	19 3 7	25 1 23	25 1 16	5 2 16	23 2 12	188 12	189 6 or 57·42 p. c.
IV. Two Bullocks fed on Wheat, Oats and Barley (in Covered Shed).							
11	9 1 16	11 2 10	11 1 14	2 0 22	10 2 20	85 6	88 4
12	10 2 5	12 3 2	12 3 7	2 0 25	12 0 14	97 0	97 7
Total of 2 bullocks	19 3 21	24 1 12	24 0 21	4 1 19	22 3 6	182 6	186 3 or 58·38 p. c.
V. Two Bullocks fed on Wheat, Oats, and Barley (in Open Yard).							
13	9 2 0	11 1 20	11 0 22	1 3 20	10 1 24	83 10	85 1
15	10 1 14	12 2 16	12 2 0	2 1 2	11 3 0	94 0	98 1
Total of 2 bullocks	19 3 14	24 0 8	23 2 22	4 0 22	22 0 24	177 10	183 2 or 58·93 p. c.

Taking next the cost of the additional foods consumed during the whole time we have:—

				£	s.	d.
(a)	Linseed-cake	1350 lbs.	cost	4	18	8
	Dec. cotton-cake	1350 „	„	4	1	3
	Maize-meal	1350 „	„	3	19	5
				£12	19	4
(b)	Bean-meal	„ „	„	5	2	5
	Oats	„ „	„	4	14	5
	Barley	„ „	„	4	1	4
				£13	18	2
(c)	Wheat	„ „	„	4	1	6
	Oats	„ „	„	4	14	5
	Barley	„ „	„	4	1	4
				£12	17	3

These would give the following as the relative cost of each mixture per lb. of increase of live weight:—

	Relative cost per lb. of Increase in Live Weight. d.
(a) Linseed-cake, decorticated cotton-cake, and maize-meal	2·62
(b) Beans, oats, and barley	3·17
(c) Wheat, oats, and barley	3·2

This shows clearly the superiority of the cake-feeding as against the other foods, at the prices at least which they cost at the farm where the experiment was carried out. On examining the carcases, the meat of the cake-fed beasts was pronounced by experts to be "riper" than that of the bean-fed beasts, while similarly the meat from the bean-fed ones was very superior indeed to that from the wheat-fed bullocks, the fat of the latter being very pale in colour. Beyond this is also to be considered the great superiority of the cake-fed manure.

XXV.—*Fruit Evaporation in America.* By Dan. Pidgeon, Holmwood, Putney Hill, S.W.

The appearance at the Nottingham Show of an American "Fruit-Evaporator," an appliance in common use by farmers of the United States for the purpose of drying apples, peaches, raspberries, and other fruits, created a great deal of interest among advanced agriculturists.

As one of the Judges of Miscellaneous Implements whose duty it was to adjudicate upon the claims of this Evaporator to be regarded as a "New Implement," and entitled, therefore, to compete for the Society's Silver Medals, I took the opportunity, whilst in America this autumn on other business, to

inquire into the present development of the fruit-drying industry in the United States. The following brief notes sum up the information which I was able, in the short time at my disposal, to obtain upon the subject.

The town of Rochester, in the State of New York, is the recognised centre of the industry in question, which has already assumed immense proportions. The rapid growth of fruit-drying in this region throws incidental light upon a somewhat obscure question, viz., "Why is the British farmer so slow, and his transatlantic cousin and competitor so quick, in adapting himself to altered conditions of cultivation?"

Illustrations of the *fact* are not far to seek. The entry of the Great West, in the character of a wheat-grower, upon the agricultural stage of the world created a "depression" in the agriculture of the Eastern States of America no less marked than that which followed from the same cause in England. New England, no more than Old England, could, after that entry, any longer afford to raise the traditionally "important crops." A change of front became inevitable there, as here, and was made with a rapidity which England might envy, but has not approached.

Thanks to the mine of statistical wealth embodied in the quinquennial Census of Massachusetts, it is possible to measure the depth of the depression in question in one of the most densely populated States of the Union. More than half the towns in the leading agricultural county of Berkshire, Mass., lost fourteen per cent. of their inhabitants between 1865 and 1875, while in Middlesex, the second farming county in the State, one town in every five parted with three-fourths of its people during the same period.

Yet the agriculture of Massachusetts has not declined. The farmer has, indeed, given up raising the "important crops," but their place has been more than filled by an increase in the production of milk, eggs, vegetables and fruit. Twelve times as many eggs and forty times as much milk are now produced in this State, than was the case thirty years ago; while the increase in such crops as beets, carrots, beans, cranberries, and onions is almost equally great. The total value of the farm-produce of Massachusetts *increased* by nearly twenty per cent. within the ten years ending 1880, notwithstanding the fact that many farms, once the homes of prosperous men, are going begging for customers at a tenth of their original cost, while the population of all the agricultural towns is slowly dwindling.

If Massachusetts has survived an "agricultural depression," it is because the Yankee is a totally different person from the

English farmer. Tenancy for rent is practically unknown in America, although men sometimes let some of their land upon the "Metayer," or share-of-profits system. The farmer is always a freeholder, and the farms are small. More than half of those in Massachusetts, for example, are between twenty and one hundred acres in extent. The greater part of the remaining half are smaller, while there are very few properties containing more than three hundred acres. For every four of these farms, again, there are but three labourers. Whatever the theoretical advantages possessed by the English triad of squire, farmer, and labourer, it is beyond all doubt that the American combination of freeholder, husbandman, and labourer in *one* man, stimulates energy and develops ingenuity in a very remarkable manner.

Western New York, again, was itself formerly the granary of North America, and Rochester was a city of mills. All has changed with the introduction of Western wheat. Wheat-fields have become orchards; the mills, once thickly lining the banks of the Genesee River, have disappeared, or become factories; the very citizens have forgotten their old pride in the "Flour City," and now call their town (without reason, it must be confessed) the "Flower City." Throughout twelve of the most fertile counties of Western New York, the cultivation of fruit, especially of apples, has, within fifteen years, superseded that of every other crop. The orchard products of New York State were valued at nearly nine million dollars in 1880, the last census year, and will probably be worth far more in 1890. The greater part of these apples are grown around Rochester, where, within a radius of forty miles, nearly two thousand fruit-drying establishments are now in operation.

Only by the aid of these "Evaporators" could such a condition of cultivation as that now prevailing in the district under review be maintained. Thousands of tons of apples are prepared annually from grades of fruit formerly wasted or allowed to rot on the ground. The fruit-drier and the extension of fruit-farming have gone hand-in-hand, and, following naturally upon their union, the dried-fruit merchant has appeared, and flourishes. He does not himself evaporate fruit, but buys both from Evaporating establishments and the farmer, packs for export, and exploits the whole world for markets. Chief among these gentlemen in the town of Rochester ranks the firm of Michael Doyle & Co., to whom the writer gladly acknowledges his obligation for nearly all the information on the subject of fruit-evaporation to be found in this article.

Glancing, first, at general facts indicating the character and

extent of this new industry, 1,500 evaporators were at work in the neighbourhood of Rochester during the year 1887, and some 150 more were started during 1888. These range in capacity from 25 to 1,000 bushels of apples per day. The 1,500 Evaporators in question gave employment, during the autumn and winter of 1887, to 30,000 hands, who earned from 5 to 12 dollars each per week, according to skill and experience. The total quantity of dried apples produced was about 30 million pounds, and their value two million dollars. Five million bushels, or 250 million pounds of green apples, were required for this purpose, from which more than 200,000 tons of water were driven off by the consumption of 15,000 tons of coal.

The product finds a market all over the world, but the chief consuming countries are Germany, England, Belgium, Holland, and France. Evaporated apples are packed in cases each containing 50 lbs., and the cost of carriage per case to Liverpool is 30 cents, or 1*s.* 3*d.* The same quantity of green fruit sent in barrels would cost $2.50, or 10*s.*, and canned fruit $2.10, or 8*s.* 9*d.* In the case of evaporated fruit no damage is done, even by the longest transit, while fresh fruit suffers enormously, and canned fruit is always liable to ferment.

The refuse of the apples, consisting of cores and parings, is not lost, for these also are dried, and form the basis of all the cheap jellies now so largely manufactured. Twelve millions of pounds of dried cores and parings were exported from America during the year in question. Sliced apples, dried without coring or paring, are exported in large quantities to France, where they are used in the production of the cheaper wines, and, sometimes, by the distiller. Eighteen thousand barrels, containing four million pounds of sliced apples, were sent to France during 1887, and of this quantity more than half was furnished by the Rochester Evaporators. The dried apples of Western New York can now be bought in almost every town on the continent of Europe, while an increasing demand for them is springing up even in such remote parts of the world as Australia and Western Africa.

Passing from the general to the particular, it may, in the first place, be remarked that the practice at Rochester is to dry not only apples, but peaches, plums, and raspberries.

Green Apples are bought, in average years, at from fifteen to twenty cents (7½*d.* to 10*d.*) per bushel of 50 lbs. The actual cost of drying averages from twelve to fifteen cents (6*d.* to 7½*d.*) per bushel. The total cost of the dried product is from six to ten cents (3*d.* to 5*d.*) per lb., and the average selling price seven to twelve cents (3½*d.* to 6*d.*) per lb. One bushel of green apples produces about 6 lbs. of dried apples. The best apples are

barrelled and exported as fresh fruit, only the second-grade fruit is evaporated, while a third-grade goes to the cider-mills at an average price of $7\frac{1}{2}$ cents ($3\frac{3}{4}d.$) per bushel. Nothing is wasted. The cores and parings are dried and sold for jelly-making at an average price of $20 (4*l.*) per ton. A bushel of apples yields 30 lbs. of "meat" and 20 lbs. of refuse. The 30 lbs. of "meat" is reduced to 6 lbs. by evaporation, and the 20 lbs. of refuse to 4 lbs. One pound of coal is consumed in evaporating one pound of fruit.

Peaches are dried both in the "pared" and "unpared" state. The cost of a bushel of good peaches, in average years, is fifty cents (2*s.* 1*d*). Each bushel yields $4\frac{1}{2}$ lbs. of dried "pared," and 8 lbs. of "unpared" fruit. The actual cost of drying, in both cases, is fifteen cents ($7\frac{1}{2}d.$) per bushel, the cost of the dried "pared" product fifteen cents ($7\frac{1}{2}d.$) per lb., and its selling value twenty to twenty-two cents (10*d.* to 11*d.*) per lb. The cost of "unpared" dried peaches is eight cents (4*d.*) per lb., and the selling value from ten to twelve cents (5*d.* to 6*d.*) per lb.

Raspberries (black) cost, in average years, six cents (3*d.*) per quart. A quart of fruit yields one third of a pound of dried product. The actual cost of drying is two cents (1*d.*) per lb., and the total cost of the dried raspberries twenty cents (10*d.*) per lb. The selling price varies from twenty-five to thirty cents (1*s.* $0\frac{1}{2}d.$ to 1*s.* 3*d.*) per lb.

Plums are only evaporated when so abundant as to become unsaleable. One bushel of green plums produces 8 lbs. of dried fruit, whose average selling price is seven cents ($3\frac{1}{2}$) per lb.

Fruit evaporation is mainly an independent business. The 1,500 evaporating establishments already mentioned as surrounding Rochester are all of this character. The farmer indeed owns a dryer of his own whenever his orchards are large, but he sells for the most part to the nearest "Evaporator." Apple orchards in Western New York are commonly from 100 to 300 acres in extent, Peach orchards from 50 to 150 acres. The Evaporators themselves vary in capacity from 10 bushels to 1,000 bushels a day.

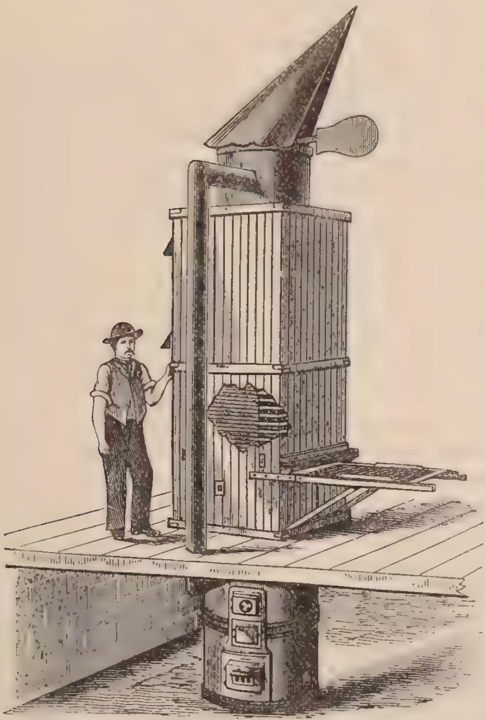
The smaller drying apparatus is of the simplest description. It consists of an iron stove, surmounted by an upright wooden casing, the stove being fixed in the basement, and the wood casing on the floor above. The products of combustion are carried away by a flue, while the hot air rising from the stove passes upwards through the box-like dryer, which terminates in a cowl and vane. The dryer itself is fitted with a number of sliding trays, made of wire netting, upon which the fruit is placed, and these are replenished by hand as the drying proceeds.

Evaporators of the greatest capacity do not differ from the smallest in principle, but the former usually employ steam instead of fire heat. The cost of the smaller (Farmer's) apparatus is very trifling, and the cost of coal has already been stated as 1 lb. per lb. of evaporated fruit.

Mechanical appliances for coring and paring apples are extremely ingenious and very numerous. They are worked by hand, and are continuous in action, i.e. one apple is being "chucked" while a second is being pared, and a third cored. Peach-paring machines are also in vogue, and cherries, when these are dried, are stoned by a very pretty special machine. None of these mechanical adjuncts to the system of fruit-evaporation are expensive, although it must be said they are all especially American productions.

The cut below gives a good idea of a small Farmer's dryer,

A Farmer's Evaporator.



and the apparatus is so simple as not to require an additional word of explanation.

Whether fruit-growing and fruit-drying are likely to assist the British farmer as they have assisted the farmers of New York State in a predicament of exactly similar character, is a question yet to be solved. One thing, however, is certain, that a little of the alertness which, within fifteen years, has changed the old granary of America into an orchard, and the "Flour City" of Western New York into a fruit-drying centre, might be imported with advantage, even if the methods resulting from such importation took other forms than that which this paper attempts to outline. A second thing is, in the writer's view, equally certain—that the conditions under which the British farmer works must at least approximate to those which surround his freeholding competitor in the States before he can, prudently, plant fruit trees.

XXVI.—*Barley from a Maltster's Point of View.* By Robert Free, Mistley, Essex.

The art of making good malt out of bad barley has not yet been discovered, and hence there is usually a range of 20*s.* per quarter in the prices which maltsters are prepared to pay for the various samples of English barley offering on the markets during the season. Nevertheless, the cost of producing barley worth 45*s.* per quarter is practically the same as that of producing barley worth only 25*s.*, and, leaving out of account the influence of unfavourable weather, such as we have had this season, there is no valid reason why so large a proportion of the barley grown in this country should be of inferior quality. The British farmer has, unfortunately, many adverse circumstances to contend with which are wholly beyond his control, but that is surely the best reason for seizing every available opportunity of turning the land to profitable account, and for making the most of produce in which there yet remains a chance of competing successfully with the foreigner. If I remember rightly, Mr. C. S. Read and Mr. Albert Pell, in their joint report to the Royal Commission on Agriculture, gave it as their opinion that our farmers could in future only hope to hold their own against more favourably situated foreign and colonial rivals, in grazing and the growth of barley. As regards the grain with which my thirty years' experience as a maltster has made me familiar, I do not hesitate to endorse their views, but with the condition, which must of course have been expressed or taken for granted by them, that in the struggle which has practically become one for very existence, British growers should not neglect any one of the essential elements of success.

There are possibilities in barley which I say emphatically have not been realised, and, indeed, speaking generally, I do not scruple to add that the most obvious means for their realisation are lamentably and wilfully neglected. As a rule we have stood still or retrograded whilst foreign and colonial growers have steadily improved their methods of cultivation, and consequently the quality of their produce. The main object of the present paper is to point out, in the plain language of a business man, the causes which tend to the production of so large a proportion of inferior barley in this country, and the means of improvement which suggest themselves. I shall also add information which will, I think, be instructive as well as interesting, as to what becomes of the barley after it reaches the maltster's hands. There can be no question as to the importance of the subject, and I am aware that it is one upon which great diversity of opinion is sure to arise. But I shall depend chiefly upon facts and figures that have come under my own observation, though for the purpose of this article I have sought the assistance of various authorities to whom allusion will be made later on.

It is indisputable that whilst during the last thirty years rapid progress has been made in every other branch of industry in this country by the adoption of new and improved processes dictated by scientific discoveries, agriculture has not made a proportionate advance. So far as barley for malting purposes is concerned, I am of opinion that the average quality of the season's crop was better twenty or thirty years ago than it is now. Of course I do not refer to the exceptionally bad prospect of this year for quality, as it is due to climatic causes, nor do I pretend to discuss agricultural chemistry or the results of scientific farming. But in the matter of barley growing there are certain plain means to the desired end which have been, to an almost incredible extent, neglected. The general absence of care in the selection of seed is perhaps the most radical defect. Buyers of grain are not usually backward in pointing out the shortcomings of samples submitted to them, and therefore the growers can scarcely plead ignorance as to what is required in a malting barley. They know at all events that amongst the first conditions looked for are that the grain should be well matured and evenly ripened; and yet it is a fact that thousands of acres of good arable land in this country are regularly sown with such samples of barley as the farmer finds unsaleable to the maltster in consequence of their inferior quality or condition, or with the cheapest lots that can be bought on the markets. Worse still, there are large quantities of "screenings" purchased from the maltsters and dealers at a low price, and then dressed and sown.

Perhaps I should explain that these latter generally comprise the "screenings" from all the different parcels of barley, English and foreign, that the maltster has received into store during the season, maturing early and late, short-strawed and long-strawed, thick-skinned and thin-skinned, good coloured and bad coloured. These are all inextricably mixed, and ought only to be bought for feeding purposes, where the mixture is of no consequence. One might as well expect to gather "figs from thistles" as to secure a good even harvest of barley from this mixed refuse as seed!

This is not a matter of science, but of common sense. If rubbish be sown, it would be strange if there were anything but rubbish to reap. As, however, the object of the farmer is to grow malting and not grinding barley, it is simply suicidal folly to sow his fields with what could not, by anything short of a miracle, produce the desired result, even if the season were the most favourable ever known. I am aware, of course, that motives of economy are accountable for the practice referred to; but a very little calculation will suffice to convince those who have hitherto adopted it that it is the height of false economy, since the difference in cost between "screenings" and best seed barley at two bushels to the acre is infinitesimal as compared with the relative value of the respective crops.

It may be said that I am deprecating only extreme and exceptional cases; but the same rule holds good throughout. Most farmers seem to think that barley is barley, and that cheapness is the one desideratum in buying their seed. They do not, it is true, all sow "screenings," but, on the other hand, very few of them go to the trouble and expense of selecting their seed; and yet there are as many varieties of barley, good, bad, and indifferent, as of other kinds of agricultural produce. If the fruit-grower means to cultivate pears or the florist roses, he takes care to select the best stock for his purpose, and even in regard to wheat the farmer does not display the same amount of happy-go-lucky indifference that he does with respect to barley, though quality really affects the market value of the latter far more than that of the former. The miller cannot, like the maltster, afford to give long fancy prices for fine samples of grain, because the conditions of his trade preclude the possibility of an adequate return; whereas the maltster is always ready to pay handsomely for exceptionally fine parcels of barley, because really first quality malt readily commands a relatively high figure. Nor is there any secret about the reason for this. The brewers obtain a considerably higher price per barrel for their fine than for their ordinary ales, and as they reckon three to four barrels

to the quarter of malt, it is easy to understand why they should be willing to pay higher prices for really fine malt. Moreover, there are several of our leading brewers (it would be invidious to mention names) who will not buy inferior malt at any price, and therefore farmers who grow only poor barley are necessarily shut out from a considerable portion of the market altogether.

These considerations all point directly to one conclusion, viz., that the aim of our farmers should be to grow the best malting barley, and to this end it is imperative in the first place that they should select the best seed. I will now mention a few varieties of barley that experience has proved to be best adapted for malting purposes, but it must be understood that of recent years they have one and all of them sadly deteriorated by mixtures, owing to the want of care in preserving the several kinds intact. The "Chevalier," the "Golden Melon," and what is known as "Page's Barley," are amongst those which may be relied upon in a fair season to ripen evenly and give a mellow, thin-skinned barley; but doubtless there are in every barley-growing district other kinds which have secured a local reputation equal to those named. There are also "Saale," "Austrian," and "Hungarian" barleys which possess the desired qualities, and which might also be used for seed with advantage. The great thing is to bear in mind the properties desired by the maltster, viz., that the grain should be of good size, evenly ripened, mellow, and thin-skinned, and to select with care and judgment seed of this character. I do not mean to say that it will prove at all an easy task, for the reasons already given, but it is certain that vast improvement on the present slipshod methods might be immediately effected, and if the demand existed for really first-class seed barley, there is no question that in a year or two the supply would be forthcoming.

Having touched upon the initial stage, let me add a few words upon the subsequent operations of cultivation and preparation for market. Let it be clearly understood at the outset that I do not presume to minimise the inevitable influence of the season upon both the quantity and quality of the crop. In this variable and capricious climate it frequently happens that unfavourable weather will nullify all the farmer's best efforts and most careful calculations. Nor is it possible wholly to prevent the losses thus occasioned. My remarks must therefore be held to apply to the circumstances of an average season, and they are based upon my own observation and the experience of leading farmers whom I have consulted. The description of soil best suited for barley varies so much with the season that it is quite impossible to lay down any hard and fast rule. Sometimes

light sandy land, at others good mixed soils, or in a dry year even deep clays, will yield the best harvest of barley. And a change of seed from heavy to light land and *vice versâ* has often proved beneficial; but the condition of the land is of consequence.

There seems to be a general consensus of opinion that it is not necessary to manure for barley, unless indeed the land be in an exceptionally impoverished state, and that the effect of artificial manure is to produce a heavier crop of straw, but not to improve the grain. Barley generally does best as the succeeding crop to wheat or roots, especially if the land has been well manured for them, and under such circumstances nothing is gained by manuring for barley itself. The practice of sowing barley in the autumn does not seem to be warranted by results, for the crop is generally moderate as to quantity, and there is no certainty of any appreciable advantage as to quality. But it should be sown as early as possible in the spring—that is, directly the ground is dry enough to be well pulverised—and care should be taken not to put in too much seed, say not exceeding two to two and a half bushels to the acre, for the grain is sure to be poor if the plants are too thick. It has often proved a great mistake to sow seeds along with barley, as is commonly done in many districts, for in a wet season the clover gets as strong as the barley, and is pretty certain to spoil its colour either in the field or in the stack. As good a layer of seed is secured by drilling after the barley is above ground, and then at harvest-time there is no undergrowth to contend with.

These are of course controversial questions in practical farming about which I do not presume to speak dogmatically, not being a farmer myself; and hence I have relied chiefly on recognised authorities with whom I have been in communication, including Mr. Amis Hempson, of Ramsey, Essex, Mr. Edward Catchpole, of Kelvedon, and others whose courteous assistance I desire to acknowledge. But a maltster's views may be held to have some weight in regard to the operations of harvesting, dressing, &c., because they materially affect the condition and the value of the barley. It too often happens that the farmer's convenience, and not the fitness of the barley, is the predominant factor in determining when it shall be cut. Indeed, many farmers do not hesitate to say that it is immaterial whether the grain is ripe when it is cut, for, if not, a few days in the field before carrying it to the stack or the barn will suffice to mature it. I am convinced that this is altogether a mistake so far as barley for malting purposes is concerned. It should be allowed to ripen thoroughly before the scythe is put in, for thus only can

a really mellow grain be secured. When cut too early the grain becomes steely, and hence of far less value to the maltster.

It is at harvest-time that the evil effect of using mixed seed manifests itself, for some kinds of barley will ripen fully a fortnight earlier than others, and it follows that if these be sown together, a part of the crop will be dead ripe before the rest is fit to cut, and an evenly matured sample is therefore simply impossible. Steam thrashers, which are now almost universally employed, have of late years proved more satisfactory than formerly, because of the improvements introduced in them, but I venture to think that there is still room for further progress in this direction. With a properly constructed machine the awn should be knocked off without in any way injuring the grain, as too often happens, and care should especially be taken not to set the thrasher too close, or the skin of the corns will be cut and mould ensue. In respect to "dressing" I have one practical suggestion to make, which if acted upon would prevent much of the disappointment occasioned to buyers and loss to the sellers of barley. The common practice is to "dress" only once; but a second dressing would be found not only to give satisfaction, but would prove positively remunerative to the farmer, as the following simple calculation will demonstrate:—

	£	s.	d.
100 qrs. barley once dressed at 29*s.*	145	0	0
96 qrs. barley twice dressed at 30*s.*	144	0	0
4 qrs. of screenings at 20*s.*	4	0	0
	148	0	0
Cost of dressing 100 qrs. at 1½*d.*		12	6
	147	7	6

showing a difference of 2*l.* 7*s.* 6*d.* in favour of the second dressing.

Assuming, however, that the best barley has been sown, and that the methods of cultivation, harvesting, and thrashing employed upon it leave nothing to be desired, there is yet another vicious practice only too common with English farmers, which must be corrected if they want to deliver the grain to the maltster in perfect condition. I refer to the custom of storing the barley in great heaps on the barn floor, for days or even weeks at a time, without turning it over, until it has acquired an earthy, or as it is sometimes termed, a "mushroomy" smell. Now it is superfluous to point out that there is always a certain amount of moisture in the grain, which, as it lies in a heap, must sooner or later induce a certain heating and sweating. This in its turn not only produces the disagreeable smell referred

to, but also injures the germ, and consequently the growth of the barley. Farmers generally wait till the mischief is done before they take measures to guard against it; in other words, they do not think there is any need to have the barley heap turned so long as it does not smell badly. The fact is, however, that when once that "mushroomy" scent has been acquired, the quality of the grain has deteriorated beyond reparation. It is far better to be on the safe side and have the heap turned over every few days. The cost is trifling, and all danger of damage is thus avoided.

In one of the communications alluded to above, the following passage occurs, and I quote it because the opinion expressed is perhaps shared by many of the writer's confrères, and it is desirable that it should be corrected: "A good deal of injury has been done to the barley and malt trade by the rush for barley in the autumn, and the large customers leaving off buying so early. If large deliveries could be taken during February and March, farmers would feed the market more regularly, and the barley would be much better kept in the straw than in the huge heaps by the maltsters, which are now general." It is a farmer who writes thus, and it affords a curious illustration of Æsop's fable, wherein the wolf charges the lamb with fouling the stream, though it flowed from him to it. The responsibility for the state of things complained of lies with the farmer, not with the maltster. It would obviously be greatly to the maltster's advantage if the deliveries of home-grown barley were extended uniformly over eight months of the year, instead of being for the most part compressed into four, because he would not then be compelled, as at present, to receive and store eight months' consumption in half that period. The "rush" complained of is assuredly not of his creation, but it is due to the fact that in times of agricultural depression, which are now unfortunately chronic, farmers are, generally speaking, in haste to realise before Christmas.

Before proceeding to follow home-grown barley from the farmer to the maltster, attention must be called to the ever increasing competition of imported barleys, because this should serve to stimulate English producers to fight the foreigner with the only weapon left to them, viz. quality. The repeal of the malt duty has acted very much against the interests of the farmer by opening an immense field to foreign barley for malting purposes that did not previously exist, since the heavy duty of 21*s*. 8*d*. per quarter formed a protection to English producers, as the best and worst barleys were liable to the duty if once steeped. There was always a risk of foreign barleys not germinating

IMPORTS OF BARLEY INTO THE UNITED KINGDOM [see page 500].

Countries	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
Australasia	—	—	105,574	201,791	53,082	1,737	4,670	12,337	12,322	10,841
Algeria	—	46,277	331,295	315,319	26,160	32,876	343,859	819,723	336,198	249,296
Austrian Territories	82,618	—	6,064	34,635	132,135	367,705	392,361	744,040	481,287	366,500
[1] Bulgaria	—	—	—	[1] 146,316	97,948	79,730	43,617	124,496	37,314	—
[2] Canada	57,892	140,085	35,678	2,083	—	36,901	400	8,870	274	2,816
Chili	—	60,353	249,147	3,397	6,851	52,859	291,777	152,583	165,338	73,081
Denmark	1,854,103	2,122,752	2,118,457	1,376,908	1,062,914	750,034	226,874	612,119	973,306	827,512
Egypt	—	94,306	125,254	59,971	48,467	95,945	225,340	62,516	—	44,493
France	459,568	625,680	1,165,175	2,001,182	909,685	1,475,713	1,281,262	1,424,600	1,033,323	620,406
Germany	3,150,017	3,600,513	2,636,847	1,692,306	2,175,536	1,794,914	724,532	609,142	1,205,750	933,181
Holland	70,306	105,631	141,473	126,504	78,846	7,049	118,087	57,592	67,633	55,525
Malta	4,052	—	65	—	—	1,900	6,450	1,719	—	—
Roumania	1,068,653	1,533,987	2,417,681	1,887,134	5,719,985	4,460,601	1,401,211	2,377,519	2,347,898	2,341,837
Russia	4,827,663	2,473,104	1,491,464	1,167,922	4,097,344	5,517,049	4,965,593	6,524,542	5,548,459	7,462,536
Sweden	460,587	491,028	466,047	229,129	556,685	397,502	176,088	169,648	540,256	601,956
British India	—	—	—	—	—	—	—	—	201,073	69,211
Turkey	1,026,868	89,301	83,540	[1] 251,964	513,344	1,183,051	2,403,631	1,288,738	648,793	175,877
United States	1,084,562	158,521	328,345	273,859	47,578	118,756	226,659	135,913	49,809	369,419
Other countries	10,030	4,776	3,184	35,524	14,002	87,006	120,604	240,063	73,576	68,544
Total	14,156,919	11,546,314	11,705,290	9,805,944	15,520,112	16,461,328	12,953,015	15,366,160	13,722,609	14,273,034

[1] Bulgaria was included with Turkey prior to 1881.
[2] Including small quantities (if any) brought from other parts of British North America.

properly, and in that case the maltster would be liable to very heavy loss. Consequently, only the selected foreign barleys of the finest description were used, and these barleys always commanded high prices, and did not therefore seriously injure the English farmer; and further, at that time there were many growths, such as Smyrna, Algerian, and other Southern sunripe barleys, that could have been used with great advantage to the brewer, but were prohibited by the excessively high duty they would have to pay. The Government levied the duty by making the charge upon the grain after it had been steeped for fifty hours in the cistern, and as the barleys named—being so perfectly dry—absorbed such a large amount of water, the increased duty would be equal to an additional charge of 7*s*. or 8*s*. per quarter. Since the repeal, the brewer only pays upon the extract in his mash tun. This difference, therefore, now no longer exists, and consequently large quantities are regularly used, as well as many varieties of sunripe barleys from Southern Europe and the East, which certainly have a material effect upon the average price of barley.

The Table on page 499 shows that whilst our imports of foreign barley have fluctuated considerably during the last ten years, their amount being regulated to some extent by the quantity of home-grown barley available, still the total has not materially increased, the figures for 1878 being practically the same as those of last year, and no rule being observable in the years intervening. Nevertheless, it is undoubtedly a fact that the quantity of foreign barley used in malting has of late years steadily increased, and therefore I can only suppose that the relative cheapness of maize has affected the consumption of foreign barley for distilling and grinding purposes. Unfortunately, there are no means of putting this to the proof by statistics, as no record is kept of the sources from which malting barley is supplied. It will be observed that Southern Russia now sends us fully one-half the total foreign supply, and that Roumania comes next with about 500,000 quarters, or more than double that of any other country except Russia. These Roumanian barleys are classified in the trade as Danubian, and latterly they, as well as Russian, have been to a considerable extent employed in malting on account of the comparatively low price at which they were attainable. This year, for instance, Russian has actually been selling at half the price of average English barley, say 13*s*. 6*d*. to 18*s*. per quarter, and a considerable quantity of the best qualities have been used for malting purposes.

Next to Russia and Roumania comes Germany with nearly 250,000 quarters, then Denmark with over 200,000, then the

Pacific ports of the United States with 180,000, then France with over 160,000, then Sweden with over 150,000, and then the Austro-Hungarian Empire with under 100,000. A considerable proportion of all these barleys are purchased for malting purposes, and there can be no doubt therefore that foreign barleys are now more largely used in malting than formerly, though, unfortunately, no statistics are available to show to what extent this is the case. The excise authorities at Somerset House keep a return of the quantity of malt and sugar annually consumed in brewing, which I append, but there are no means of ascertaining what proportion of the malt owes its origin to home-grown and what to foreign barley respectively:

	Malt and Corn in Quarters.	Sugar in Tons.	Equal Qrs. of Malt, at 2 cwt. per Qr.
1887	6,539,027	73,297	732,970
1886	6,484,884	66,347	663,470
1885	6,486,186	64,279	442,790
1884	6,601,695	59,304	593,040
1883	6,416,431	56,307	563,070
1882	5,848,070	57,109	571,090
1881	6,487,405	56,267	562,670
1880	5,136,559 (9 months' return)	66,029	660,290
1879	6,447,111	52,000	520,000
1878	7,344,116	56,000	560,000

I have already mentioned that some of the Saale, Austrian, and Hungarian barleys are of excellent quality, and as an illustration of what may be done by determined effort in the matter of seed selection and cultivation, I would refer especially to the marked improvement that has taken place of recent years in Danish barleys, a large proportion of which now take rank with the average of English growths for malting purposes. Only a few years ago the barley production of Denmark was practically confined to a coarse thick-skinned native grain suitable only for distilling or grinding, and the change is mainly due to the energetic action of the Danish Royal Agricultural Society, with the assistance of the Government. In 1883 a committee of the Society was formed to ascertain by what means of cultivation, &c., the best possible quality of barley, yielding the greatest commercial value, might be obtained, and a subvention of 300*l.* per annum was granted by the State to the Society for this purpose. The committee accordingly distributed some 800 lots of seed, each consisting of half a hundredweight of fine "Chevalier" barley, to farmers in districts where it was found that barley could be profitably grown. The condition was imposed upon every recipient that he should report

the results of the experiment, and an annual exhibition of malting barleys was established in Copenhagen, when their commercial value was appraised by experts. It has been found, that in every case, out of seven or eight kinds of imported seeds, the "Chevalier" gave the most profitable returns to the farmer, and this has naturally led to its general adoption.

The experiments in cultivation have also had an important influence. Early sowing was found to be most satisfactory, for the spring in Denmark is generally dry, and it was therefore desirable to get the seed into the ground while it retained some of the winter moisture. As to harvesting, it was ascertained that the best time to cut was when the grain was fully matured and the ears began to droop. Useful hints, based on the experience gained, were also circulated among the growers by the Society as to stacking, thrashing, and storing, and the practical result of the whole has been to revolutionise this branch of agriculture in Denmark, the annual money outlay, be it observed, amounting to no more than 300*l.* It is now estimated that one-third of the arable land in Denmark is devoted to barley culture, and the total yield is about 2,750,000 quarters.

Having briefly referred to the various sources from which the maltster obtains his barley, let me describe what becomes of it after reaching his hands; and it may fairly be said that, speaking generally, he has shown eagerness in adopting all the improvements in his processes that chemistry and mechanical science have been able to suggest, so that the modern practice of malting differs materially in its methods from that in vogue thirty years ago, though the principle of course remains the same. With all its faults and shortcomings, English barley is delivered in much cleaner condition than the bulk of the foreign, but even it requires considerable dressing and screening before it is fit for the steeping tanks, whilst as regards the Smyrna, South Russian, and some other Eastern barleys, they invariably contain an admixture of tares, seeds, and dirt which it is essential to remove. Hitherto agricultural implement makers have designed their screening machinery with a view to its being used upon English-grown barley, or at any rate for barley grown by farmers who take the trouble to keep their land clean and free from tares, and who use thrashing machines of some description or other. But it is otherwise with the Eastern barleys, and hence elaborate automatic screening machinery has been invented for the purpose. My firm erected such a plant last year in connection with our new maltings at Mistley, and as it does its work with wonderful precision and thoroughness, a brief notice will be of interest.

The barley passes through two sets of machines. The first, known as the "Victoria Separator and Eccentric Grader," does the rough work, separating the sample into coarse refuse, large tares, and three grades of barley. This machine is, in principle, a series of five reciprocating sieves, with different sized perforations. These sieves or screens deliver at different spouts the material passing over them, and are worked from an upright shaft by eccentric and connecting rods. An exhaust fan acting on the barley sucks up any fine dust or light grains, and delivers the refuse, which collects in an enlarged pocket of the main pipe, by a spout into sacks. The exhaust can be regulated by a movable sluice to any degree of suction.

It can readily be understood that simple sieves will not extract broken or half-corns, nor tares of a diameter equal to that of the barley. This machine alone is, therefore, insufficient to do the whole of the work, and the final cleaning is done on other machines, consisting of six pairs of cylinders, each about 2 ft. diam. and 8 ft. long. The cylinders are arranged in pairs. one over the other, the upper cylinder acting as a separator to extract the smaller tares and half-corns from the whole barley, and the lower as an ordinary screen. The upper cylinder is not perforated, but covered with hemispherical indentations smaller than the length of a grain of barley, though larger than half a grain. Hence the half grains, tares, and other seeds left from the first machine fall into the indentations or recesses, and are carried round in them until they fall into a trough below, in which an endless screw works, and delivers into sacks at the end of the machine. The whole-grain barley, which is thrown against the side of the upper cylinder above its horizontal centre line, is kept from going round with the cylinder by a series of scrapers, resting on the cylinder as it revolves. The full grains, of course, cannot fall completely into the recesses in the cylinder, and anything projecting from the recesses is pushed out by the scrapers, and by them conducted into the feeding trough to be presently described.

The barley is fed to the different cylinders by an endless screw working in a trough at the ends of the cylinders, and at right angles to them. In this trough are openings delivering the grain into the cross or feeding troughs, one to each upper cylinder. In these cross troughs revolve blade propellers throwing the corn, as mentioned above, against the revolving cylinder in an oblique direction. The barley is thus being continually thrown up by the blades, and returned to the trough by the scrapers, and at the same time gradually advanced by the oblique action of these blades. In this way the seeds and half-corns are gradually separated as the barley travels along the trough and cylinder. The barley passes then through the lower or screwing cylinder, where it is acted upon by a second exhaust fan, to draw off all light corns and other refuse which are useless for malting purposes, and which had escaped the action of the first machine.

It must, however, not be supposed that screening machinery is only useful on foreign barley. Owing to imperfect thrashing, English barley is often broken. Broken barley is useless and injurious to the maltster, and the machinery above described may be advantageously used for separating these half-corns in English barley.

Owing to the extended use of various foreign barleys, and especially to the numerous improvements in the art of brewing that have taken place of late years, the process of malting has become of a far more scientific character than formerly. Each class of barley requires different treatment in the cistern, on the

floor, and on the kilns, and the brewer is far more exacting in his requirements in the manufacture of malt than formerly, so that the maltster's powers are severely taxed to produce the best possible article from the material he has to deal with. To treat the grain with advantage, it is necessary to have well constructed maltings, and to this end I may personally claim to have made many considerable improvements. I will now describe the process that the barley undergoes after it has passed through the screening and cleaning machinery already noticed, which is the most perfect and effective yet constructed. By its means the bulk is greatly improved, and is then in a fit state for the first stage of malting, viz. the cistern.

In most cases cisterns are constructed upon the ground-floor of the malting. Consequently, when the barley has undergone the required amount of steeping, say from 50 to 60 hours, it is drained and removed from the cistern by manual labour with shovels on to the growing floor. This process causes a serious amount of damage, as the men are obliged to stand upon the soft and swollen grain during the whole of the time required to empty the cistern, and they cannot possibly avoid crushing some of it during the unloading. Every kernel that is so damaged produces mould during its growth on the floors, and this spreads afterwards to the other grain. To remedy these evils, and to save the hardest labour in the malting, I planned a self-emptying steeping cistern with a cone-shaped bottom. These cisterns are placed on the upper floors, and are emptied by means of a valve at the bottom of the cistern, so that after the barley has undergone the necessary steeping, it is let down by means of iron shoots on to the different growing floors, thus saving all manual labour, and damage to the grain. This method of emptying does not occupy more than a few minutes, against two or three hours by the ordinary process. So much does the maltster value the necessity of avoiding all friction by which the grain may become damaged, that we have also constructed such machinery as will convey the barley from the railway and farmers' waggons by elevators to the granary floor and thence on to canvas conveying bands; and by a simple but ingenious contrivance, we are able to shoot off the grain into the cistern or to any desired part of the extensive barley stores without the slightest handling.

The barley, after it has left the cistern, is then laid on the floors to a sufficient thickness (varying according to the temperature of the season) for generating the necessary amount of warmth to stimulate the germination of the grain. This is a point that requires great care, as any excess of temperature is

most injurious to the future growth of the grain. It is of the greatest importance that the germination should commence throughout the entire bulk as nearly as possible at the same time, otherwise it is impracticable to make a perfectly even conversion of the grain. Vegetation will usually start in from twelve to twenty-four hours, and as it proceeds it is requisite to turn the barley so as to prevent a too rapid growth, which would materially injure the quality of the malt. This is, however, only one of the risks which the maltster has to avoid by the exercise of constant watchfulness; for, on the other hand, it is sometimes needful to promote the growth by increasing the depth of the grain and by sprinkling it with water, and under any circumstances a judicious application of moisture is requisite during the early stages of vegetation. I may here say that it is upon what is called the working or growing floor that the maltster's skill and judgment are fully brought into play, as it is a fact that immense quantities of grain are made into what is called malt, whereas it is nothing better than spoilt barley. It is not my intention in this paper to write a minute description of the process of malting, as this would involve an article in itself; but I desire to state that it is upon the growing-floor that the maltster has to contend with all the evils that have been caused by the want of care on the part of the farmers, viz. unevenness of ripening, damage by thrashing, and defective condition when delivered.

So soon as the barley has gone through the process of germination on the floors, which should be completed in about ten or twelve days from the time it is unloaded from the cisterns, it ought to be in a fit state for kiln-drying. This operation forms a most important and valuable part of the manufacture, as no good malt can be produced unless carefully and perfectly kiln-dried. It is the kiln-drying that regulates the colour of the malt, which is varied according to the purposes for which the malt is required; but, in every case, it is imperative that the malt should be evenly and thoroughly dried, whether it may be required for the finest pale ales or for any other description of malt liquors where a certain amount of colour may be desired. In these cases it is most important that the malt should be so dried that during the process it should not sustain the slightest scorching or burning. The old kilns are so constructed as to render it almost impossible to avoid injury to the malt in this respect, as the drying-floors are too near the furnace and the means provided for properly regulating the temperature are very defective. The greatest care is therefore essential on the part of the working maltster, and this cannot always be relied upon.

Though these are serious faults, they have always been known

to exist, and it will be easily understood that as maltsters we have always been desirous of obtaining some effectual improvement upon the old means of kiln-drying.

A number of alterations for the better have been made during the past few years, but it was only a few months since that I was able to perfect a principle by which we have obtained all the advantages in kiln-drying that we have so long desired. The results obtained are such as to entirely revolutionise the previous system of drying. When the barley is first loaded on to the drying kiln, it is generally laid to a depth of ten or twelve inches, and occupies between three and four days in drying. It is always found, even in the best constructed kilns, that a considerable difference exists in the temperature, that of the malt at the top being many degrees lower than that underneath. Consequently, if not regularly turned on the kiln, the malt is liable to partial burning and discoloration, which frequently occurs when an attempt is made to dry malt at a high temperature. This is owing to the want of a current to carry the heat through the whole of the malt; and to obtain that result I have always been striving. After numerous costly experiments, I have at last succeeded in obtaining the power of perfect drying we have so long desired. To effect this I have made the following alterations in what is known as "Free's Patent Malt Kiln," the construction of which gave excellent results by materially increasing the draughts and giving a very equal distribution of heat to the whole surface of the drying-floor. Under the new principle we construct the roof as nearly air-tight as possible, and place in the neck of the steam outlet a "Blackman's Air Propeller" or exhaust fan, by which we draw through the grain about 20,000 cubic feet of air per minute. This in itself tends to purify, sweeten, and bleach the grain when first loaded, and to carry the moisture entirely away, instead of allowing it to continuously condense in the bulk of the grain, which it must necessarily do by the ordinary plan. As the air always contains more or less moisture, I have fitted a large number of iron pipes in the furnace shaft, which become heated by the furnace so as practically to remove the moisture from the air which passes through them. Consequently an enormous volume of perfectly dry hot air is continuously drawn through the perforated floor of the kiln and the malt lying upon it. By the aid of a set of carefully constructed dampers and the corresponding regulation of the air propeller, it is possible to increase or decrease the temperature of the kiln at will, and it is found practicable to dry off at a far higher fire heat temperature than can possibly be done by any other system.

Every practical man will at once recognise the importance of these improvements, as affecting the quality of the malt, hops, and other produce. The process of drying need no longer be governed by rule of thumb, for by these new appliances it becomes a scientific process capable of being regulated to a nicety. Equally important to the maltster, with its influence upon the question of quality, is the effect of the new system upon the time occupied in drying. By its means we can now dry off the same quantity at a far higher temperature in one third the time hitherto necessary, and in constructing new maltings the requisite kiln space may therefore be proportionately reduced.

The old theory of malting was that the process of vegetating barley needs to be conducted in the dark, and without air as well as light, so that the level of the growing-floor was generally excavated to some feet below the ground. There was barely room for a man to stand upright upon it without knocking his head against the floor above, and ventilation was conspicuous by its absence. Now this idea has been altogether exploded by modern experience, and the new maltings just erected by my firm at Mistley (which we claim to be amongst the largest and most perfectly constructed in the kingdom) consist of five floors each averaging eight feet in height from the floor, and all of them thoroughly ventilated and lighted throughout. The block of buildings occupies an area of about 200 ft. in length by 140 ft. in depth, of which about one-fourth is occupied by the kilns, malt stores, engines, &c. Of the remainder, the top floor, measuring 140 ft. by 120 ft., is devoted to the storage of barley after it has been screened, and is capable of holding between 8,000 and 10,000 quarters, and the other four contain the steeping cisterns, and are used as "growing floors." It is found that so far from light and air being detrimental to the growth of barley, they are positively beneficial, and it stands to reason that malt made under such conditions must be superior to that manufactured in the badly constructed buildings which still do duty as maltings in many places throughout the country.

In the process of malting barley a remarkable property is developed in the grain which is known to chemists as the diastase, and its importance in brewing lies in the power which it possesses of rapidly and completely converting the starch cells of the malt into brewing sugar. Now it is the presence of this diastase which has of late years led to the preparation and sale throughout the civilised world of large quantities of "Malt Extract" for medicinal purposes. It is found to be an effective aid to digestion, and it also contains valuable nutritive and

strengthening properties, so that a new use for barley malt has been created, and it is steadily increasing. Hitherto a large proportion of the malt extracts sold in this country have been of foreign origin, chiefly American and German; but recently large works equipped with machinery and plant of the latest and most approved type have been erected at Mistley in close proximity to the maltings of my firm, and the manufacture of extract is now being carried on there by the "Standard Malt Extract Company" from English malt of the finest quality, and therefore under conditions which ought to render its product equal if not superior to anything of the kind at present in the market.

This paper has already extended to greater length than I purposed at the outset, and it only remains for me to summarise the conclusions to which my remarks have tended, viz., 1. That the Repeal of the Malt Tax opened the door to foreign competition in malting barley more widely than ever before. 2. That maltsters and brewers are rapidly adapting their appliances and practices to the changed conditions thus created. 3. That English farmers can still grow barley to a profit, but to accomplish this it is essential that they should pay due attention to the selection of seed, that they should employ only the most approved methods of cultivation, and that they should exercise great care in regard to harvesting, thrashing, dressing, and storing the grain.

It is not in any spirit of captious criticism that I have written, but my mind has been solely influenced by the desire to stimulate our growers to improve the quality of barley. By so doing they would increase the money return from the land, and at the same time confer a decided benefit on the brewing trade of the kingdom.

XXVII.—*Report on the Farm Prize Competition in Nottinghamshire and Lincolnshire in* 1888; *Class* 1. By Frederick I. Cooke, Flitcham Abbey, King's Lynn.

It has been customary of recent years for the Local Committees appointed to make preparations for the annual country meetings of the Royal Agricultural Society to offer prizes for the best managed farms within a certain radius of the town where the Show is to be held. This example was followed by the Nottingham Local Committee, who offered, in connection with the meeting of 1888, prizes amounting in all to 300 guineas for the

best managed arable and grass farms in the counties of Nottingham and Lincoln, together with such portions of the counties of Leicester and Derby as are contained within a district of ten miles beyond the boundary of Nottinghamshire.

The competing farms were divided into three categories as below :—

CLASS 1.—For the best managed arable and grass farm of 300 acres and upwards, of which not less than one-half shall be arable. First prize, 100 guineas; second, 50 guineas.

CLASS 2.—For the best managed arable and grass farm above 100 acres and not exceeding 300 acres, of which not less than one-half shall be arable. First prize, 50 guineas; second, 25 guineas.

CLASS 3.—For the best managed arable and grass farm above 25 acres and not exceeding 100 acres. First prize, 50 guineas; second, 25 guineas.

The competition in all three classes was limited to tenant farmers paying a *bonâ fide* rent for at least three-fourths of the land in their occupation, no competitor being allowed to enter more than one farm for competition. In the event of a competitor having more than one farm in his occupation, he had to declare which of his farms should be entered for competition, but at the same time he had to define the whole of his occupation, both as to position and area, so that the other farms might be inspected (though not for competition) if the Judges thought necessary.

So many entries were made for these liberal prizes that it became necessary to divide the work of inspection between two sets of Judges, one set taking the 15 farms entered in Class 1, and the other set the 20 farms entered in Classes 2 and 3. The present Report is concerned only with the farms competing in Class 1,[1] the Judges of which were :—

JOSEPH MARTIN, Highfield House, Littleport, Cambs.
RICHARD BRITTEN, Abington Grange, Northampton.
FREDERICK I. COOKE, Flitcham Abbey, King's Lynn.

All the Judges met the Secretary of the Society to receive final counsel and instructions on the evening of Monday, December 12, and started before daylight the following morning on their first round of inspection.

There is little opportunity in the short days of winter, if the work is to be got through in reasonable time, to see much more than the buildings, the live stock, and the roots of the several farms, with such portions of the grass lands and the remaining arable as are necessarily brought into view in the walk. Nor

[1] The Report on the other two Classes, from the pen of Mr. Thomas Stirton, of Stratton, is necessarily held over until the next number of the Journal.—ED.

would there be much advantage in a closer inspection at the dead season. It is usually quite enough to yield very useful preliminary indications of the master and his skill.

The second visit was begun by the reporting Judge on the 4th of May, and all the Judges started for the third inspection on the 25th of June.

Before describing in detail the management of the competing farms, the writer proposes to follow recent precedents in giving a brief and general sketch of the leading features of agricultural interest which characterise the two whole counties open to the competition.

Lincolnshire.

Lincolnshire has been described as, agriculturally speaking, the premier county of England. It certainly possesses many natural advantages of a high order, which on the whole have been turned to first-rate account. The great diversity of soil under plough or in grass throughout the large area of the county, and the exceptionally fertile character of so much of it, have led to equal variety in its distribution amongst owners and occupiers. All vexed questions of large *versus* small estates or holdings have here had a free and favourable field for their solution. That is to say, they have been very much left to settle themselves by the only really sound and economical process of natural selection, which, despite its simplicity, may be safely trusted to work for the best in the long run.

Thus there are the usual large estates with their large farms where the land is of a character to attract men of capital and skill, and to yield the safest return from treatment on a large scale; whilst the small cultivators, as owners or occupiers, have chiefly settled upon the richer but less easily cultivated soil, where expensive artificial stimulants are not so essential to the production of good *crops*, and where labour is the principal investment required.

But whether in large holdings or in small, both classes have been distinguished for excellence of cultivation, and for the character of the live stock upon them.

It may be that here and there a less satisfactory picture has just now to be acknowledged, but if so the shadow may be traced with little difficulty to the passage of those clouds of recent years which have more or less frowned upon us all. Nowhere has the trouble been more felt than upon the wheat-growing soils of the smaller farmers, who, on the whole, may not be as well armed as the larger farmers are with the advan-

tages of capital, enterprise, and modern acquirements with which to meet it.

In *area* Lincolnshire is second in size of the counties of England, Yorkshire only being larger. It contains in gross extent of land and water 1,767,962 acres, 28,000 of which is waste or uncropped land.

Some of the following tables of statistics have been suggested by those in Mr. Little's Report of last year, which the writer feels to have been much too interesting and useful to be neglected as a precedent in this.

Thus, the table below shows the *population* of Lincolnshire and Nottinghamshire, and the number of persons per square acre in each county, with the same particulars of England for comparison :—

—	Lincoln	Notts	England
Population in 1881	469,919	391,815	24,608,391
No. of persons per square acre	·27	·74	·75

Lincolnshire therefore, in spite of a large proportion of small holdings, as will be shown directly, is very thinly populated, much less densely than Notts, or than England as a whole. The number of people per square acre is singularly alike in the two latter cases. The census returns readily explain the anomaly by showing how few persons are engaged in Lincolnshire in any industry other than that of agriculture, the only other in fact of any note being—fittingly enough—the manufacture of agricultural implements, which is considerable.

The number of persons per 100 acres engaged solely in agriculture is about the same in both counties. The proportion of permanent grass in the total cultivated land is, as will be shown, rather less than one-third for Lincoln, and for Notts but very little less than a half, so that more hands per acre of arable land must be employed in the latter county, and this too in spite of the fact that Lincolnshire contains the larger proportion of small holdings, which usually absorb the most labour.

The Distribution of Holdings of Land.—Lincolnshire is very much a county of large estates, and, as usually follows, of large farms. Thus there are 14 owners of 10,000 acres and upwards, a number exceeded only in the case of Yorkshire, where there are 31 such owners, and by Northumberland, where there are 17. The area of Yorkshire is, however, more than twice that of Lincolnshire. The average number of such owners per county

for all England and Wales is four. Again, the number of owners of 1,000 acres and under 10,000 in Lincoln is only exceeded in the two cases of York and Norfolk. In the latter there are 211 such owners, in Lincoln 210.

On the other hand, Lincolnshire is almost as remarkable for the great number of small owners of land in it. Thus, there are no less than 13,380 people who own each an acre or more of land, but under 50 acres. Yorkshire, with its enormous area, has only 21,701 of such occupiers, and most other counties are left very far behind indeed in this comparison.

The principal owners are the Earl of Yarborough, Lady Willoughby de Eresby, Mr. H. Chaplin, Lord Aveland, the Marquis of Bristol, the Crown, Earl Dysart, Mr. C. Turnor, and others with estates almost as large.

The following table gives some interesting particulars of the number of farms of certain sizes in the counties of Lincoln and Notts, with corresponding figures for the whole of England:—

Classes of Holdings	Lincoln		Notts		England	
	Percentage of holdings of a given class to whole number of holdings of all sizes in county	Percentage of acreage of holdings in a given class to total acreage of county	Percentage of holdings of a given class to whole number of holdings of all sizes in county	Percentage of acreage of holdings in a given class to total acreage of county	Percentage of holdings of a given class to whole number of holdings of all sizes in England	Percentage of acreage of holdings in a given class to total acreage of England
From $\frac{1}{4}$ acre to 5 acres	32·01	1·42	28·14	1·32	29·96	1·19
From 5 acres to 50 acres	44·10	13·43	45·33	14·60	41·08	13·13
From 50 acres to 100 acres	8·43	10·48	9·59	12·48	10·83	13·19
From 100 acres to 300 acres	10·48	32·21	13·39	41·96	14·26	41·32
From 300 acres to 500 acres	3·21	21·27	2·63	17·95	2·75	17·39
From 500 acres to 1,000 acres	1·58	17·62	·82	9·02	·99	10·83

In Lincolnshire there are 43 holdings of above 1,000 acres each, and in Notts six such holdings. There are practically no uncultivated farms in either county.

There are in Lincolnshire 11,710 occupiers of allotments, detached from cottages and less than half an acre in size, and in Notts 14,795. Of garden allotments attached to cottages there are 15,251 in the former county, and only 5,209 in the latter. The much larger proportion of detached allotments in Notts

must be owing to the demands of miners and others who are not of any agricultural class.

The following analysis shows the distribution of detached allotments according to size:—

Number and Percentage of Allotments or Field Gardens of different sizes detached from Cottages, in June, 1886.

Counties	Under ⅛ of an acre	Of ⅛ acre and under ¼ acre	Of ¼ acre and under 1 acre	Total	Total acreage in all classes of holdings	Percentage of total allotments in total acreage
Lincoln . . .	1,782	3,765	6,163	11,710	1,510,825	·77
Notts	9,445	3,751	11,599	14,795	455,085	3·25
England . . .	128,566	116,487	103,819	348,872	24,891,539	1·40

In all, 478 labourers have runs for a cow in Lincoln, but only 28 in Notts. Further particulars under this head will be given subsequently.

Physical Aspects.—The fens and marshes of Lincolnshire, which comprise about one-third of its *surface*, are about as flat and level as the sea—an aspect dreary and depressing in the extreme to the unaccustomed eye of the average Briton, yet not, it is well to know, without power to kindle some of the finest imaginations. For the charms which have so unfortunately been hidden from common mortals have, happily, been revealed to a Tennyson and a Kingsley, who both actually sang the praises of these flat districts—the former finding rapturous similes between the glories of fen and sea. The area in question includes the whole south-eastern portion of the county, and a wide fringe of marsh skirting its eastern sea-board. It extends also up into the centre of the county as far as the city of Lincoln, near which it is called the "Carr." On its eastern and western borders it is relieved by a double range of calcareous hills, which, starting from the neighbourhood of Brigg, at the north of the county, for an apex, run down, the one in a south-easterly, the other in a south-westerly direction, so as to form two sides of a rather acute triangle enclosing the fens. From the moderate elevation of these hill-tops, the western range of which forms the magnificent site of the Cathedral of Lincoln, a sufficiently extensive and interesting view may be had, over the gentle dip and rise of a fertile and varied landscape, to redeem the county from unfair charges of universal flatness.

The *Rivers* of Lincolnshire are somewhat insignificant, if we

except the Humber, which is the northern boundary of the county, and the Trent, which marks its western limits, only entering for a little at its north-east corner. These are both liable to disastrous floodings, owing in part to periodical visits from a tidal phenomenon called the "eager" or "bore," which causes a rise of waters sometimes to the extent of six or eight feet.

Geology.—The concealed rocks, the upper surfaces of which are being continually powdered down into Lincolnshire soils by nature's constant friction of many kinds, belong to what is called the Middle Period. They are found in a fairly complete series from the Trias to the chalk, and succeed one another in ascending order from the east to the west of the county, so that the different beds of rocks lie in parallel belts from north to south. Of these beds some are of clay and some of limestone. The softer clay yields first to the continual washings, and longitudinal valleys in the direction of the beds are thus formed between the more stubborn layers of limestone, which consequently in time stand out in more or less bold ridges above them. This comparatively simple arrangement of surface soil is, however, complicated to a rather unusual extent by huge deposits of "drift," a material mostly composed of clay and sand which was brought down at a later period from other districts on the back of the huge ice sheets which slowly swept over the face of the country in the glacial period.

The total consequence is seen in that immense variety of *Soils* which has been previously referred to, and from what has already been said of the lie of the rocks it will be seen that by far the greatest variation would be found in crossing the county from east to west, or *vice versâ*. The soil of the eastern range of hills or wolds is a sandy, flinty, or chalky loam, with occasionally a rich loam or chalky marl. Along both the eastern and western borders of this range, or parts of them, is a band of rich brown loam, or of poor cold clay, with, in some places, a better clay soil. Easterly of this again is a fringe of rich marsh grasses bordering the sea. The soil of the western range of hills, which north of Lincoln is called the Cliff, and south of it the Heath, varies from a very light to a good sandy loam. Westerly of these hills is more grass land of various quality. The fens and carr-lands are mostly of two kinds, (1) the dark and peaty soils—relics of submerged forests of a former period; and (2) those low-lying lands, or marshes, nearest the sea, which have received a greater or less deposit of alluvial silt from tidal sources. A very large area of land has in this way been reclaimed from the Wash within recent years. Amongst both

these divisions of fen soil are spots of higher land, which were alone above the level of the floods in pre-drainage times, and now—as perhaps then—principally in grass of first-rate quality. The peaty fens have a subsoil of soapy blue clay, but the black surface soil is of a light character. Some of the alluvial lands are also of a lightish nature, but others are much wetter and heavier in surface as well as subsoil. Elsewhere are found clay and greensand soils, and very numerous examples of artificial or drift soils which are much too various for classification.

The *climate* of the higher grounds of Lincolnshire is noted for its fine, dry, and bracing character—too much so, perhaps, for the county is peculiarly exposed to cutting easterly winds in the spring. These may have been even more fierce than now, for where the ancient forests of the fens have been exposed to light, the buried trees are often found leaning from the effects of the chilling blasts. Before the present effective drainage, these fen districts were productive of constant ague and other diseases to their inhabitants. The rainfall, like that of the other great corn-growing counties of the eastern coast, is considerably below the average for England as a whole. One good test of the mean temperature of a district is roughly supplied in its suitability or otherwise for the growth of mangolds. The agricultural returns show that Lincolnshire—and most probably its more southern part—is about the most northerly limit of the profitable cultivation of this root. Thus the acreage in mangolds as given for the county of Norfolk, immediately below it, is four times as great as that returned for Lincolnshire. Yorkshire, next above, grows less than half as much as Lincoln, and there are no more than 190 acres of this warmth-loving plant returned for the whole of the large county of Northumberland. Happily the prohibition, though a proof of lower temperature, is not without its compensation, for no doubt this is fully provided in the more and more favourable climate for turnips of one kind or another which each northward step secures.

Acreage under various descriptions of crops.—The following table shows the percentage of the total acreage of arable land in Lincoln, Notts, and England under each kind of crop, or in bare fallow, in 1887. It also shows the percentage of the total acreage of cultivated land in the same places, which was in permanent pasture in 1887. In an adjoining column are the same particulars for 1877, in order that it may be seen what alterations or modifications of previously prevailing systems or rotations of crops, if any, have been induced by a long period of low prices for farm produce.

CROP STATISTICS, 1877 AND 1887.

Description of crops	Lincoln		Notts		England	
	1877	1887	1877	1887	1877	1887
Corn crops :—						
Wheat	27·07	21·74	24·23	18·56	22·20	17·75
Barley	17·28	18·19	17·49	14·05	14·86	14·21
Oats	8·90	11·07	7·02	12·45	11·07	14·28
Rye	·17	·16	·65	·96	·36	·37
Beans	3·57	3·34	2.91	2·57	3·49	2·82
Peas	2·04	1·88	2·91	1·71	2·27	1·82
Total corn crops	59·03	56.38	55·21	50·30	54·25	51·25
Green crops :—						
Potatoes	3·45	4·32	2·01	2·64	2·25	2·98
Turnips and swedes	12·87	13·03	12·45	13·54	11·11	11·46
Mangolds, &c.	1·89	2·04	1·41	1·55	2·58	2·84
Cabbage, &c.	1·91	1·40	·50	·61	1·41	1·29
Vetches and other green crops except clover and grass	2·10	2·09	2·15	1·99	3·12	3·07
Total green crops	22·22	22·88	18·52	20·33	20·47	21·64
Clover, sainfoin, and grasses under rotation … For hay	6 97	8·55	9·23	12·46	11·96	13·80
Not for hay	9·06	9·37	10·95	11·56	8·38	9·02
Total	16·03	17·92	20·18	24·02	20·34	22·82
Permanent pasture … For hay	6·21	7·57	11·46	14·68	13·32	15·75
Not for hay	22·52	23·95	24·44	29·13	31·35	34·58
Total	28·73	31·52	35·90	43·81	44·67	50·33
Flax	·13	·02	—	—	·05	·02
Hops	—	—	·01	—	·52	·51
Bare fallow or uncropped land	2·51	2·73	5·99	5·27	4·28	3·68

The figures are not revolutionary, and on the whole can hardly be said to prove any very unusual or considerable departure from previous practices. On the contrary, they appear rather to support the opinion of many competent men that no very great alteration of the kind is practicable or advisable. At the same time the wheat area has certainly been markedly reduced, even in the county of Lincoln, a great part of which is so thoroughly adapted to its cultivation. But probably upon that part the reduction has only taken place to a limited extent. More than half the deficiency of wheat is, it appears, made up by an increased acreage of barley and oats. The rotation grasses

are more by nearly two per cent., and the permanent grasses more by a little over three per cent., than they were in 1877, the increase in permanent grass out of the total land cultivated being nearly exactly equal to the decrease of wheat amongst arable crops. In Notts nearly four per cent. less wheat was grown in 1887 than ten years ago, two per cent. more barley and oats, four per cent. more rotation grasses, and eight per cent. more permanent pasture. The decreased acreage of wheat in England is as nearly as possible the same as in Lincoln, but the increase of permanent pasture is nearly twice as much, namely, six per cent.

So far as their opportunities for observation and inquiry served them, it appeared to the Judges that the newly laid down grass was chiefly confined to the thin and intractable soils of both the counties visited, and that there was a growing tendency—in Nottinghamshire particularly—towards leaving the rotation grasses for a second year, but seldom longer.

Live Stock Statistics.—The following table gives similar statistics of live stock to those of the crops:—

LIVE STOCK STATISTICS, 1877 AND 1887.

Showing number of each kind of Stock per 100 acres of cultivated land in Lincoln, Notts, and England in 1877 and 1887.

Description of stock	Lincoln		Notts		England	
	1877	1887	1877	1887	1877	1887
Horses:—						
Used solely for Agriculture	3·26	3·30	3·26	3·20	3·13	3·07
Unbroken and kept solely for Breeding .	·97	1·13	1·16	14·13	1·23	1·32
Total Horses	4·23	4·43	4·42	17·33	4·36	4·39
Cattle:—						
Cows and Heifers in Milk or in Calf	3·58	4·20	4·96	6·15	6·40	7·38
Two Years old and above	4·72	5·03	5·01	5·09	4·41	4·65
Under 2 Years	5·06	6·37	6·28	7·45	5·55	6·50
Total Cattle	13·36	15·60	16·25	18·69	16·36	18·53
Sheep:—						
One Year old and above	62·45	49·28	37·79	28·68	47·22	39·84
Under 1 year	38·60	33·25	25·16	20 82	28·16	26·16
Total Sheep	101·05	82·53	62·95	49·50	75·38	66·00
Pigs	6·96	6·11	6·39	5·33	8·69	7·78

These figures appear to prove the lamentable fact that the larger acreage of permanent grass has not resulted in an increase of the total number of stock in either of the counties under consideration, or in England as a whole. We are, therefore, producing less corn by decreasing its acreage, and probably diminishing its yield, whilst not at the same time making more meat in its place. Yet the main arguments for the change have been the greater profits from the production of meat, and the better opportunities of meeting our foreign competitors by its means rather than by the growth of corn. It may be right to suppose that it will pay better to have land under grass than under corn, but wrong to think that we necessarily increase our capacities for the breeding and feeding of stock by such means. A little attention to the particulars of the first and second prize farms, which will be given presently, will go far to show that the meat returns from very poor land, which is in great part arable, can be made much greater than those from similar land laid down to grass, if not indeed from those also of the richest pasture land of the country.

Whilst dealing with a county in which both large and small holdings are so exceptionally represented, the writer thinks that a comparison of the numbers of stock kept upon each of these classes respectively will be of some interest.

The following table has been prepared for the purpose from Government Returns obtained in June, 1885, and shows the number of farm animals under their several heads per 100 acres of land in large holdings of above 500 acres but not exceeding 1,000 acres, with the same particulars for small farms of above 50 but not exceeding 100 acres of land.

Description of farms	Horses per 100 acres	Cows and other cattle per 100 acres	Sheep and lambs per 100 acres	Pigs per 100 acres
Large Farms of above 500 acres, but not exceeding 1,000 acres . . .	3·33	11·16	103·19	4·24
Small Farms of above 50 acres, but not exceeding 100 acres	4·89	22·83	50·92	9·13

Large farmers and small, therefore, seem to keep about the same number of horses in proportion to their acreage. The smaller holders are clearly much stronger in cattle, and just about as much weaker in sheep, whilst the pig, of course, is a favourite animal with the smaller capitalist. It appears likely that the value per acre of the live stock as a whole would in each case be singularly uniform. But it is to be feared that a

return of the yields per acre of other produce would be found less favourable to the smaller holdings.

It would be difficult to speak too highly of the types of live stock which are to be found on Lincolnshire farms.

The prevailing breed of *Cattle* is the shorthorn, although the term is perhaps a little too general to describe them with sufficient accuracy and justice. There is no doubt that many of them still retain, in some degree, the distinctive points of the "Old Lincolnshire Ox." The constant use of pure-bred bulls upon cows with some of this blood about them has at length developed the celebrated modern animal which has for so many years been shown in great perfection at the large fairs of the county, whence they have been eagerly bought and widely distributed. The best cattle of to-day are of the rich red colour which has been prized and preserved for so many generations. They are both deep and wide of frame, have for the most part downpitched horns, and develop into great size and weight if allowed time to do so. But perhaps they are most of all remarkable for the fleshiness of carcase which the butcher is sure to find with them, a matter of more and more importance in catering for modern tastes.

It is sad, however, to be compelled to add that the average quality of Lincoln store cattle, as shown at the present fairs and markets, has greatly deteriorated from the high standards of only a few years ago. A part of the relapse may be, and it is to be hoped is, due to modern improvements towards earlier maturity. The lower values of store cattle may have revealed more painfully the unprofitableness and waste to some one of breeding a good animal, or buying a good calf, and neglecting to keep it well, or allowing it to lose its early condition and be carried over two or three comparatively unproductive summers and winters before seriously attempting to fit it for the butcher. Where, as in Lincoln, the expensive system of rearing the calves on new milk has extensively prevailed, the waste must be proportionately greater. How much of the deterioration of store animals is due to this cause, and how much to the mistaken economy of using inferior sires as perhaps practised by the many smaller breeders, cannot be shown here, but about the fact of the deterioration itself there can be no question.

The chief breeding districts are in the north-eastern and south-western portions of the county, and in spring and autumn the occupiers of the rich grazing grounds in the fens and other parts, as well as many strangers, come to buy of the breeders at the numerous large fairs in their neighbourhood. The importation of Yorkshire and Irish beasts for feeding is no doubt growing.

There is very little dairying done in the county, unless it is quite in the immediate neighbourhood of the larger towns. Most farmers, large or small, keep a few cows and rear their produce.

The present Lincoln *Sheep* are probably, in most cases, much-improved descendants of the "Old Lincolnshire Long Wools." These in their time have been known as coarse and unshapely animals, though remarkable for weight of wool—a much greater consideration in earlier days than at present—and for size of frame, which was also of more value when large joints were saleable, and quality not put so much before quantity by the public. Extraordinary weights of wool and mutton are given by these sheep after some years of improvement, as much as 14 stones of 14 lbs. per carcase being mentioned. They were very hardy, and therefore well suited to the climate as well as to the soil of the county. There are several famous breeders of Lincoln rams in the county, one of whom will be mentioned particularly. Sheep that would attain great weights were till lately in much demand for summer grazing in the fat pastures of South Lincolnshire, but modern tastes and prices have quite changed the system, as even in many cases the breed itself.

Very contrary opinions were expressed to the Judges by different feeders and breeders upon the ability of the white faces to hold their own in the future, some asserting that they must at any rate be crossed with more "colour" because they sell so badly, whilst others maintained that they had not found it so. Much appears to depend upon the place of sale. If a local one the depreciation is not, it seems, by any means so apparent as it clearly is, for instance, in London. Still we do not wonder that the Lincoln men stick to their breed, for not only are the sheep so well acclimatised, but they are less liable to lameness than many others, they finish quicker on the kind of winter food which is given them, and, if the writer's judgment serves him, they are more fitted to the summer treatment they receive.

The *Draught Horses* are of the Shire Breed, and excellently do they represent its famous and characteristic points. It may be said in fact that the breed originated in the lowlands of Lincolnshire and Cambridgeshire, although Derbyshire now appears to be rather stealing the front place.

Mr. Reynolds says in his most interesting and valuable paper on "The History of the English Cart Horse," in vol. i. of the *Cart Horse Stud Book*:—

"It is probable that in the seventeenth century, when the fens of Cambridgeshire and Lincolnshire were brought into more extended cultivation by Vermuyden and his compatriots, a number of massive horses, whose

progeny still exist as a specialty in these two counties, were imported from the continent for use in those great drainage undertakings. As late as the beginning of the present century it was not unusual for enterprising horsebreeders to import both stallions and mares from Flanders" (pages x–xi).

He then goes on to show that black was the predominating colour of draught stallions in the first quarter of the present century, and says that "the Eastern Counties horse was known and described as the 'Black Lincolnshire Horse.'"

Certain peculiarities of soil or climate, or both, undoubtedly tend to produce and preserve the much-prized points of feather and bone which so greatly distinguish the Shire breed; and Lincoln has them in abundance. A summer run on its strong pastures has a marvellous effect in building up frame and substance in any colts which are thinly put upon them. The county should therefore be able to hold its own in the competition. But whether or not Lincoln men now reap the lion's share of the Shire horse prizes, no traveller by road or rail, who sees the splendid teams in the fields or upon the roads of the county, can fail to be struck with their high average excellence, and may well doubt if it is anywhere surpassed.

The curly-coated and lop-eared *Lincolnshire Pigs* are capital animals too of their kind. They fatten readily, and make up to a great size, and with a Berkshire cross in addition can be made to suit any possible requirements. Some astonishing mountains of flesh and fat were shown to the Judges upon several of the competing farms, which were to be killed and salted for the boarding team-men, in accordance with a custom which will be alluded to again.

General System of Farming in Lincolnshire.

Variety of soil leads very naturally to great differences in its treatment, and it would probably be difficult to find any system of farm management, any description or rotation of crops, in practice or in use elsewhere, which is not somewhere or other represented within the wide borders of the county.

Lincolnshire is famous for the rapidity and thoroughness of the revolution which, beginning in earnest only towards the end of the last century, so effectually transformed its 350,000 acres of fen morass into one of the richest and most productive districts of England. At a still later period, and in still shorter time, its trackless heath, so lonely and vast that it needed, and actually had, its tall lighted beacon to guide the traveller by night, like a mariner at sea, across its barren wastes, was changed into trim and highly farmed enclosures, productive as a garden. Again, at about the same time the hitherto wild and very

extensive area of the chalk wolds was similarly turned into celebrated examples of high and skilful cultivation.

Besides all these exhibitions of public and private enterprise, there is the still vaster and more important one of the fen drainage, which was the only possible means of turning the richest advantages of the county to account. The outlay was enormous, involving a perpetual rate upon the improved land of from 3*s.* to 11*s.* per acre. The scheme necessitated embanking the old watercourses to improve natural outfalls, the cutting of numerous new drains and watercourses, and the erection of very extensive steam machinery to lift the water from those lower levels whence it could find no natural outlet. No detailed description of the enormous and interesting engineering operations of this great work can be attempted in the present report, but those wishing fuller information upon it cannot do better than consult the exhaustive report of 1851, by Mr. J. Algernon Clarke, in Vol. XII. of the First Series of this Journal (pp. 259 to 411).

The counties of Lincoln and Notts have long been associated as celebrated pioneers in the support and practice of the just principle of *Tenant's Right* to the residue of such improvements as he may have left unexhausted behind him on quitting his holding. A custom has long been in use which provides a guide and scale to valuers to fix the price of such improvements, and under it almost all occupations in the two counties have long been, and still are, held on a yearly tenure, with six months' notice to quit on either side. Leases are almost unknown. The arrangement seems to be in great favour, and certainly very capital understandings between landlord and tenant have grown up under it; such as continually lead to the retention of land in the same hands for generations. The provisions of the recent Agricultural Holdings Act are largely based on the above customs, and so much does the offspring resemble the parent, that the Act is now frequently substituted, with the cordial consent of all parties, for the custom, or an amalgamation of the two has been substituted. New tenancies usually begin at Lady Day in both counties.

The following slight sketch of the principal details of the Lincoln custom may not be out of place:—

The outgoing tenant is by it often allowed for the erection of permanent and suitable buildings which have been put up at his own sole expense, on what is called the twenty years' principle, which means that a deduction from the prime cost to the amount of one-twentieth shall be allowed for each year following the date of erection. When the material is found by landlord and the labour, &c., by the tenant, compensation to be on the ten years' principle. Special allowances are made for laying down land to pasture. The cost of underdraining is allowed on a fifteen years' principle

when the tenant finds tiles and labour, on a ten years' principle when the tenant finds labour only. Of all the above improvements due notice must be given to the landlord, and his consent previously obtained, but not to the following. Allowances on a graduated scale are made for the use of cakes and feeding stuffs (except corn grown on the farm), for bones, and for liming, claying, &c., and for customary tillages to date of exit.

Certain lands were very commonly let with a waygoing crop, which practically meant that the corn crops upon them of the harvest *after* date of exit belonged to the outgoing tenant, although the incomer had the pleasure of paying the rent, together with all the costs of collecting and thrashing. Now that farms are more difficult to let, the additional capital required to meet such a remarkable arrangement is not forthcoming. The landlords, therefore, are paying off the claim as required.

Two white straw crops together, but no more, are commonly allowed, and the usual restrictions against the sale of certain kinds of produce are very much in force. A general reduction of rent to the amount of 25 to 30 per cent. is said to have been established.

So much was heard and written of the wonders of the Wolds a few years since that the pride and glory of Lincolnshire farming must have been supposed by many to centre and culminate in that neighbourhood. Perhaps it did; but Sir James Caird in 1851 was evidently of opinion that the district was a little overrated. He named other places, though not in Lincoln, where higher standards of modern improvements—then in their infancy—had in his opinion been attained. At the same time there can be no doubt that the Wold farming had, and has, a well deserved reputation, and it was a great disappointment to the Judges that they were not afforded the opportunity, which the entry of one of these farms would have given them, of a closer inspection of the neighbourhood for themselves. Nor was this the only presumably highly cultivated district of so famed a county of which the same could be said. The richer and deeper soils of both Lincoln and Notts, whence it was hoped to reap much of both interest and profit, were practically unrepresented in Class I.

There is doubtless something of healthy rivalry between the large farms on the large estates of the two long ranges of elevated land to east and west of the county. The Earl of Yarborough heads the list of great and spirited proprietors of the Wolds, and Mr. Chaplin, of the owners of the Heath and Cliff. The land is all of light or tractable character, that of the Wolds being the better staple. Good buildings have been erected in both cases; and at reasonable rents men of capital and enterprise have embraced the opportunity of tenancy, and, in spite of some

theories of the economists, have taken and kept the lead in their calling.

The fens of Lincolnshire are, as we have seen, of two kinds, and both of them are for the most part highly productive. The peaty fens owe almost all their fertility to the soapy blue clay below them, which is so near as to be within reach of the plough in some places, and where not it is cast from trenches, at very little expense, and spread thickly on the surface. The heavier portions of the alluvial soils require under-draining. The holdings are small, 200 acres being considered a large one, and the farm buildings are mostly both inefficient and insufficient. Few roots are grown here, or cattle grazed in winter, and the holders of the best grass-lands, like those, for instance, round Spalding, usually keep the beasts which they buy at the autumn fairs very thickly in their cramped yards upon straw and cake till the spring, when they finish them on the grasses.

The course of cropping on these lands is various enough, but, so far as could be learnt, there is no great departure from the old rotation upon them of oats after a fallow, followed by seeds or pulse, and wheat again. Upon the peaty soils a good deal of rape is grown. No doubt more potatoes have been taken of late years after the fallow, and occasionally barley after the wheat, on account of the low price of the latter, but it is a very risky crop upon the fens, whilst the wheat upon well-farmed land, and in a good year, is of almost unrivalled magnificence. Few sheep are to be seen upon much of this district in the winter, save where they are required to eat the rape in the early part of it.

Some of the peaty soils have been immensely enriched by a process called warping.[1] The Isle of Axholme, at the north-western corner of the county, is a remarkable example of it. The low-lying land is there temporarily flooded from the rivers for the sake of the rich deposit left behind by the waters, and very astonishing crops indeed, particularly of potatoes, are obtained by the small cultivators who chiefly occupy it.

In the neighbourhood of Spalding, gigantic four-square stacks may be seen to tower well above the highest buildings. These often comprise the whole yield of straw from as many as 120 acres of this productive land, or all the wheat ricks of the stack-yard. The straw is carried as thrashed, sometimes for a hundred yards or more, from the mouth of the shakers in large bunches held together by pin and chain. In this position it is drawn

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[1] Described at length by Mr. J. A. Clarke in the Report above referred to. See pp. 371 *et seq.* Vol. XII. 1st Series (1851).

by an endless wire worked by the engine to the top of a pole, fixed in or near the centre of the stack, upon reaching which it is released at the highest point, to be moved by hand where required.

There is a good deal of Crown property in south Lincolnshire —entrance to which is at Michaelmas, and it certainly did not appear that these lands were any less deficient than others in their neighbourhood in building conveniences.

Good authorities give from 30*s*. to 40*s*. per acre as a common expenditure for labour upon the larger fen farms. When many potatoes are grown, it is often run up to 50*s*. Lincolnshire takes the lead amongst the counties in the cultivation of this tuber, and a very wide acreage is sown to it. It appeared indeed to the Judges, from what they themselves saw in their travels, that Lincoln ought to be able to supply the rest of England with potatoes. The area devoted to them widens yearly, not only in the fens but on the higher lands, to where they have rapidly extended, stimulated no doubt by the low price of other produce.

The arable clays, which divide the Carr lands from the Wolds to the east, and from the Heath to the west, are farmed on the four-course system. But whether under plough or grass, many of them have not a very rich or inviting appearance to the stranger, and not a few of them must be very poor and thin, and look to be quite dropping out of profitable cultivation.

The farmhouses, cottages, and outbuildings appeared to be, as a rule, good and sufficient on the larger farms and in the higher districts; but, as has been said, upon the better land, where one would suppose it to be more required, the building accommodation is decidedly inferior.

Besides the advantages already specified, the Lincolnshire farmer possesses at least one other of inestimable value which must on no account be overlooked, and it is this: He not only has access to some of the very finest grass-land in the kingdom, and to a great deal more which is at all events very useful, but the worth of this great boon is infinitely increased to him by the manner of its distribution. So that, for instance, the light land farmers of the Wolds have a fine frontage of grazing land in the fringe of famous marshes which run between their chalky hills and the sea. The Heath farmers also, and their highland neighbours, have access to a similar strip of grass, if not of equal quality to the former, running by the western foot of their oolite range. Similar advantages are enjoyed by many of the central and southern districts, where a happy intermixture of grass and arable so frequently prevails. It is this judicious blending of

a sufficiency of permanent pasture with good or useful corn-growing soils, rather than an excess of either in the hands of any one man or district, which, far better than any other arrangement, enables the best to be made of them both.

The Lincolnshire ricks are a too prominent feature in the landscape to pass unnoticed. The amount of skill and patience elaborated upon their architecture is no doubt an index of many good qualities in both master and workman, and the example might well be useful to the stackers of other and bordering counties, where this work is often done in a most slovenly and shamefully ineffective manner. At the same time, in a country of such fickle climate as ours, and where the late men often get so severely punished in the last days of their harvest, speed in rick-building is after all a very practical consideration, and the very high and steep roofs of a Lincolnshire corn-stack, to say nothing of other evidences of excessive care, may excusably be thought to delay the harvest operations rather more than some people would admit to be wise or necessary.

The farm waggons of the average or perhaps older type of the locality are of awkward and clumsy appearance to the stranger, and must be a very fair load for one horse without anything whatever upon them.

The single labourers, or the team-men, are now mostly boarded by the foreman in an adjacent cottage, instead of in the farmhouse as formerly. The Judges had several opportunities of inspecting the houses of these foremen, and were much struck with their proportions and conveniences. Extreme cleanliness everywhere prevailed within them, as well as much evident effort on the part of the housekeepers to promote the comfort and well-being of their lodgers. The well-stocked larders, with their goodly quantities of beef and mutton, are supplemented by the resources of the bacon room, wherein are hung the well-cured sides of those monsters of the sty which have been noticed before. The wages of the boarders vary from 9*l.* to 18*l.* each, according to age and capacity.

The foreman seems to have a pretty good time so far as this world's goods are concerned. One of these men on a farm we inspected —and probably the case is fairly typical, although no doubt there is considerable variation—received first of all 30*l.* yearly in money—a sort of foundation of the agreement apparently, on which was subsequently built the following additional receipts: House and garden rent free; all the potatoes required for the household; the produce of two cows kept at the master's expense; 30 stones of bacon; 40*s.* in lieu of beer; and 20*s.* per calf reared to the age of three months. Then, in further

supplement to the above, came 10*l.* in money, 30 stones of bacon, 40*s.* in lieu of beer, and 25*s.* for candles for each boarder per head. Good services are said to be obtained, as they ought, in return for this good paying and high feeding, and the convenience of having so much help always on the spot, and available for Sundays or any emergency, is considered to be very great.

Cow Allotments.—There are villages in Lincolnshire with as many as forty or more cottages which are let to farm-labourers, together with two grass fields, in the following way. One of the fields is divided by permanent marks into equal-sized allotments, each cottage having one of them. Each man mows his own plot for hay, and when made the farmer is bound to lead it to the home of the labourer who works for him. Here it is stacked for the consumption in the winter of his cow, kept in a shed on the premises. Meanwhile, as the hay is growing and making, the cows graze all together in the second field, which is held in common by all the cottagers, until the aftermath of the allotment field is fit for stocking in the same manner. There are in all about 3½ acres per man of the allotment, and a share of the grazed field. About 10*l.* a year is given for a house with these advantages, and half an acre of garden ground in addition. The men club together to effect an insurance on their animals, by which means the loss of one of them is effectually met, and no resort is made to the objectionable practice of begging with a brief. If a calf is run on the cow 15*s.* extra is paid for the summer. Formerly houses with cow runs were much appreciated and sought after, but now, with butter occasionally at 7*d.* a pound, the opportunity is not looked upon in quite the same light. The bulk of the additional work falls on the women, who, if they have large families, seem to find it quite hard enough for them.

The universal practice of the sheep-breeders, who naturally occupy the higher and lighter lands, seems to be to run ewes and lambs together upon the young seeds as soon as the turnips are finished. The lambs have no forward fold upon better pasture, and often get little or no change until weaning-time, which is frequently as late as the middle of July or into August. It is rare indeed to find vetches or any other early or late catch crop provided for them, and consequently a comparatively large breadth of what might have been hay is sacrificed to their use. At the time of the July inspection the seeds were almost everywhere so bare that it was a marvel what the sheep found upon them. Yet they seemed perfectly contented with their lot, never broke bounds, and looked in very fair condition, and the owners appeared to suffer none of the apprehensions which under such

circumstances would, it was felt, have afflicted the flock-masters of other localities. Rightly or wrongly, the advantage was put down in favour of the Lincoln breed of sheep, if it is advisable to keep them in that particular way. Almost entire reliance is placed by the larger and lighter land farmers in their flocks, whether grazing or feeding, rather than in their herds, and ewes and lambs were frequently seen upon grass grounds which had the appearance of being fit for something better.

Amongst all the peculiarities of soil and system which have now been slightly and imperfectly sketched, it will not be thought likely that there are many important farming practices peculiar to the whole, or the greater part of the county, as compared with the practices of others. One such, however, it is believed has been observed, in pursuing which Lincolnshire farmers are not only at variance with most, if not all, of their next-door neighbours, but in particular with the custom—and even the most notable of all the customs—of the county of Notts, which will be next considered. The peculiarity in question is the very unusually large proportion of stubble ground which is annually sown to common white or soft turnips, to the great neglect of the undoubtedly far more valuable swede turnips, and other roots. The Judges in Class I. drove through whole districts where not a swede was to be seen.

Now it is proverbially recognised amongst competent and observant farmers that immense respect should invariably be shown by a stranger to local customs in other counties, however they may differ from his own, since he will find them, when put to the proof, almost if not quite always to be soundly developed from a long series of accumulated and transmitted experiences. In the particular matter to be noticed, however, it may perhaps be allowable, under the friendly wing of more competent authorities, to indulge in a little scepticism. One of the authorities in question is Sir James Caird, who in writing of the Wold farming in 1851 points to this rejection of the swede turnips as a great defect, and compares the consequences with those from its very successful cultivation upon similar land, enjoying almost the same climate. Like opinions have been expressed by other writers, and, in the course of our rounds, by a very good Lincolnshire farmer who has learned the value of the swede elsewhere. Sir James and others added their belief that Lincolnshire men have seen their mistake, and are gradually conforming their practice to that of neighbouring counties, where the swede turnip is regarded as their very sheet-anchor. But as far as their limited opportunities of observation and inquiry served the Judges, there was little enough to justify the suppo-

sition. The swede turnips seemed to be in little favour anywhere in the county, except perhaps on some Heath farms, and very often the pains and expense taken to grow them there, and to preserve them from frost afterwards, are not such as to suggest a full appreciation of their value. It will scarcely be denied that the swede is far more nutritious than the white turnip, that its keeping qualities are also better, and that in most places greater weights per acre of it may be grown. Most farmers also will probably allow that swedes are a better preparation for barley than other turnips, although this experience is not always admitted in Lincoln. Perhaps it may be added, too, that the answers to our repeated inquiries why swedes were not grown were sometimes considered a little unsatisfying. At the same time it is not at all doubted that there are some lands, notably the thin clays bordering the Wolds, which will not grow swedes at all satisfactorily.

NOTTINGHAMSHIRE.

The county of Nottingham runs alongside of Lincolnshire for the greater part of the length of both counties. The former, however, is very narrow, and contains in total area only 526,176 acres, 13,000 of which are waste, or uncropped land. The population, as shown in the table already given, though much denser per square acre than that of Lincoln, is about the same as that of England generally.

Physical Aspects.—The surface of Notts is nowhere broken into hills of such ambitious proportions as that of its neighbours, Yorkshire and Derbyshire. Its slight elevations are, however, patched with abundant foliage and picturesque villages, and intersected by several rich and pretty river valleys—the average characteristics, in fact, of our much-prized English scenery. Such hills as there are run, like those of Lincolnshire, from north to south. They are in fact, and speaking now geologically, a continuation of those sections of stratified rocks, which beginning at the eastern boundaries of Lincoln succeed each other through both the counties. Notts, therefore, being a narrow county, when measured across it from east to west, the conditions are clearly not favourable to a great variety of rock formations. There are Coal-measures in the south-west portion of the county, and these are its oldest deposits. This district, with a part of Yorkshire and Derbyshire adjoining it, form altogether the most extensive coal-field in England. The Magnesian Limestone is met with in a long narrow stripe at the west of the county, and above this are the marls and limestones. But the geological formation most common to the county is the New Red

Sandstone, a bold cliff of which formed the site of the old castle of Nottingham. This stratum contains a great number of peculiar water-worn pebbles, chiefly of liver-coloured quartz rock—or "petrified kidneys," as they have been well called. The surface of the ancient forest of Sherwood, of which the Judges saw a great deal, is completely strewn with them.

The *Soils* of the county are chiefly of sand or gravel, of limestone or coal land, or of clay. The whole of the poor forest land is of the first division, and also that by the banks of the Trent. The limestone soils are at the extreme west of the county. The clay districts are of two kinds, the more northerly being very fertile because of an admixture of sand. The southern clays, which embrace the Vale of Belvoir, and are less extensive, are of a more stubborn and sterile character.

The banks of the Idle are covered to some distance by large deposits of mud, and gypsum is largely found in this neighbourhood, as well as in South Nottinghamshire, where valuable beds of it are dug for manure.

The chief *Industries* are coal-mining, and the manufacture of lace and hosiery goods. A large number of people are employed upon them, and the various centres of population so collected necessarily make healthy demands upon the produce of adjacent farms. There are also considerable maltings in the neighbourhood of Newark.

The *Climate* of Notts is a dry and healthy one, the rainfall being very considerably less than that of its western neighbours, where the loftier hills attract and hold the passing clouds to a much greater extent, whilst, as regards temperature, the fact that as many as 1,400 acres of hops have been grown at once in the county says much for its mildness in such a northerly latitude. The acreage of hops, however, declined to 55 in 1876, and to 26 in 1886, probably because recent prices of the plant could only be successfully met under the very fittest conditions. It has been asserted by some people that the temperature is so much higher than that of other counties of equal latitude, as to bring the crops to harvest in equal season with those of much more southern ones. The only evidence, however, that the Judges had opportunity to gather in proof of the statement was the late date (May 12 to 14) at which barley might be sown with reasonable expectation of its proper maturity.

There are three very large *Estates* in the county, which belong respectively to the Dukes of Portland and Newcastle, and to Earl Manvers, and the areas of which are 35,000, 34,000, and 26,000 acres. There are four other owners of 10,000 acres and above; so that Notts also may be called a county of

large estates, and there are fewer small owners in it than in Lincoln.

It will be seen by the table already given (on page 512) to show the *Size of Holdings* that the proportion of occupations of each class is very similar for both counties; the chief difference being the greater number of very large farms of over 1,000 acres in Lincolnshire.

The Shorthorn breed of *Cattle* prevails in the county, and a good many are reared on the borders of Derbyshire, where good bulls are now used, and the quality of the produce is improving. Irish bullocks are, however, largely bought at York by the great winter graziers.

The *Sheep* are principally Leicesters, or Lincolns crossed with Leicester rams, but the change to darker faces is probably extending faster here than in Lincolnshire. For a neighbourhood of 20 miles around the first and second prize farms, for instance, the Norfolk, or Cambridgeshire, half-bred sheep are chiefly bought for grazing. Pure Shropshire sheep are being increasingly bred, as also the cross between them and the white faces. But the acclimatisation of imported sheep always takes some time to accomplish, till the expiration of which it will be impossible to gauge its success. Notts has always been much more a sheep-breeding than a cattle-rearing county, and its agriculturists were amongst the first to see the importance of using the best rams, chiefly of the Leicester breed, for which they were enterprising enough to pay prices considered in early days almost fabulous. There was the old "Forest" breed of sheep peculiar to the large woodland districts, which seems to have been of by no means remarkable merit, and which is now probably extinct.

The *Shire Breed* of cart-horses is in very good favour and force, particularly upon the stiffer soils, and not a few of the Notts farmers seem rightly determined to partake in the advantages of the revival of the trade in them. Those of the Vale of Belvoir have long been famous for their successful attention to this branch of their business. Mr. Reynolds says of them in the paper already referred to: "As early as 1804 I find the breed of heavy horses was encouraged in Nottinghamshire," and goes on to specify particular stallions and their owners.

The *Pigs* most in favour are the large white Yorkshire, the Berkshire, or the cross.

It so happened that several of the competing farms occupied the site of the ancient Sherwood Forest, with all its famous history, tradition, and romance. It was, therefore, impossible that even presumably prosaic farm judges could look upon this

now productive district, with its highly cultivated fields, enclosed by the trimmest of blackthorn hedges, without a thought of the marvellous revolution which had been effected there, and much of it even within living memory. A part of Sherwood Forest was cleared for cultivation in the year 1600, but by far the greater portion was enclosed long afterwards and down to the beginning of the present century. A few picturesque bits of it even yet remain within the noble grounds of Welbeck, Worksop, and Clumber, and these three seats, almost in touch of each other, form a cluster of magnificent country seats and surroundings which even England can scarcely elsewhere rival.

The General System of Farming in Nottinghamshire.

The western division of Nottinghamshire, including the whole of the light and sandy forest district, as well as the narrow stripe of still poorer magnesian limestone land bordering on Derbyshire, is let for the most part in large holdings as compared with the rest of the county. Thus we have here again the worst land in the larger occupations, and so well farmed as to offer a good example to the smaller holders, if they need it, which I understand from my colleagues, the Judges in Classes II. and III., they do not. The smaller farmers have, however, the advantages not only of better land, but also of by far the larger share of the permanent grass of the county, if that is the saving clause in the situation which it is frequently said to be.

The chief feature of the farming of the lighter soils, as of some others which the Judges had an opportunity of seeing, is the extraordinary expenditure of labour, skill, and capital upon the cultivation of the root crop, and its remarkable success. Curiously enough too, after Lincoln experiences, the particular root which was considered worthy of all this effort was the hardy and nutritious swede, to the almost entire exclusion of the softer turnip. The Judges felt that it would be difficult to forecast whether the envy or the astonishment of the farmers of the southern counties, who were put to such terrible shifts by the loss of their roots in 1887, would have been the more excited to find, as we found, field after field, and farm after farm, with the most magnificent swedes upon them; yet this was our pleasant surprise. They were clear in skin, superb in quality, marvellously level in size, touching almost in places as they stood in the rows, and this in some cases upon land looking dear at 10*s*. per acre rent!

It was the opinion of Mr. Lowe, to whose work on Nottinghamshire Agriculture, written many years ago, the writer is

indebted for some useful information, that the introduction of the swede turnip, somewhere about the beginning of the present century, together with autumn cultivation, which is still almost universal with all good farmers, was at once marked by a very great and rapid improvement in the prosperity of Notts farmers and the general productiveness of their land. A second impetus was given by the introduction of bone manures, which still further developed the root crop resources, and brought into profitable cultivation a great deal of poor land which had previously been thought unfit for it. Other improvements naturally followed, and Notts became deservedly a county of no mean agricultural reputation.

In Arthur Young's time the Norfolk four-course system of cropping was much in favour on the lighter lands, but in recent times the practice of leaving the seeds down for a second year has been very much followed. Upon the clays and stiff loams, at the south-east portion of the county, 300 acres is considered a large farm, and 100 acres is a much more common size, and upon soils of this description, here as elsewhere, it is to be feared there has been much distress and depreciation. By far the greater part of the permanent grass is in this district, some of it of very good quality, and—as in Lincolnshire—the bullocks are mostly finished upon it in the summer, after being kept in store condition in the yard through the winter. Turnips are sown more than formerly upon the stronger soils, other than the stiffer clays, instead of a full summer fallow, and beans are extensively grown in the district. This crop is taken after seeds in preference to wheat by many of the best farmers, because of the danger from slugs to the latter. Wheat comes after the beans, and with much more success, and the seeds are sometimes left even here to a second year. Artificial manure is very little used for any crop, but the system of spreading and ploughing-in the yard manure in the autumn for roots grows amongst the best farmers, and is found very beneficial.

The hedges are remarkably good and well kept in the county generally. There have been great improvements in the drainage of the wetter soils within the present century, but it is very doubtful if it has been sufficiently continued to the present time.

There is very little dairying in the county except in the neighbourhood of the larger towns. Malt dust and malt-house sweepings are in great demand all over the county for feeding purposes and manure, but it is fully met—perhaps was originally stimulated—by the large supplies of this waste product from the numerous local maltings. Its theoretical value as a nitrogenous

food has probably been underestimated by farmers generally, and it is pleasant to know that the scientific view is so satisfactorily supported by practical experience. The Notts farmer has also a well-founded faith in the feeding value of oats for almost all classes of stock. Skegs, though now perhaps going out of fashion, is a crop which has long been grown—sometimes very largely grown—in the county, and so far as the writer knows is quite peculiar to it. Skegs are very thin and light oats, not perhaps greatly removed from wild ones. They are sown upon the worst lands, for which they are—or were—supposed to be more adapted than better varieties, a larger bulk of both straw and corn being grown from them. It is usual to chaff the whole produce for horses as it comes from the stack without thrashing.

Pigeons play a quite appreciable part in the economy of most Notts farms. The manure from the dovecote, in which very large quantities of birds are often kept, is looked upon as quite an important addition to the general supply, and a good sum is often made by the sale of the youngsters for shooting-matches.

The farm buildings are better upon the stiffer soils than those for the same class of land in Lincolnshire, and there has been immense improvement in modern times in the farm-houses, cottages, and premises of Nottinghamshire generally, until now upon many estates they are quite exceptionally good and abundant. Dutch barns are not at all uncommon, and even covered yards are growing apace, of which some details will follow.

Tenancies usually terminate at Lady-day, and leases are very uncommon. A provision of Tenant Right is, as has been said, common to both counties, and the capital of the outgoing man is adequately—perhaps excessively—provided for by Nottinghamshire custom, where the valuation on account of it mostly reaches the higher total of the two, viz. 2*l.* to 3*l.* per acre, whilst that of the lower is about 1*l.* to 2*l.* The former amount is felt and said by some Notts farmers to have become a too serious drain upon the resources of the new-comer, who must be particularly well provided with capital to afford to allow so much of it to lie dead and useless until he quits the farm. The charge also appears to remain too steadily fixed, and to slide insufficiently, if at all, with the fluctuations of the tenant's other items of receipt and expenditure. It is on these accounts no doubt that the more moderate allowances of Lincoln custom, and the Agricultural Holdings Act, are, as was said, being gradually substituted. More expensive tillages for roots, payment for manure left in the yards, and for hay and straw in any

quantity at consuming value, are apparently the main causes of the excess in Notts. No doubt such charges have always a great tendency to increase unless strenuously resisted by the valuers in combination. The principle is good beyond dispute, and when reasonably and moderately worked has everywhere produced the best possible results. The only wonder is that the just claims of the tenant to proper security of his capital should have been so long resisted or unprovided for elsewhere.

Game does not as a rule appear to be extensively or injuriously preserved in either Lincoln or Notts, yet clearly on two at least of the competing farms serious damage was done to the property of excellent tenants by the depredations of the landlord's hares. It seems not a little surprising that tenants should, at any rate in such times as the present, lack the courage to take advantage of an Act of Parliament passed expressly to meet their needs.

Another source of great injury to more than one competitor, as well as to a large proportion of Notts farmers, is the astonishing quantity of beech and other trees in the hedges. Of little intrinsic value themselves, their untrimmed arms hang in many places for yards over the crops, almost bending to the ears of the wheat, and destroying infinitely more than they are worth. Very little indeed could possibly grow under them, and one tenant stated that the little barley there was could not ripen to match the rest of the sample, and when cut had to be taken from under the trees before it would dry, and afterwards carried by itself. Destruction to the beauty of the countryside was always, it was said, the excuse pleaded by the owners of the trees, and there may be an amount of justification for the contention; but it seems, to say the least of it, unfortunate that the great cost of preserving the beautiful in English landscapes should fall upon one comparatively impecunious class of the whole community.

The plan of pulping the roots and mixing with straw chaff for the beasts is pretty well universal, each farmstead, or set of premises if there is more than one on the farm, having its fixed or portable engine for this, for grinding and for other purposes. The cost of motive power is small, coals being so cheap. Liming the fallows is very generally practised, and is usually found a complete remedy for "anbury" in turnips. Oats are much substituted for wheat in some districts.

The Duke of Portland is to Nottinghamshire what the Earl of Yarborough is to Lincolnshire, and the water meadows at Welbeck are one of the great show places of the county to agriculturists. The hard-worked Judges, however, were not so

fortunate as to be able to visit them. The site of them was originally a barren hillside covered with gorse and heath, some seven miles long, and 400 acres in superficial extent. It was all laid out many years ago in the best possible manner for its purpose at a cost of some 40,000*l.*, and the waters of a small stream, charged with the sewage of the neighbouring town of Mansfield, pass over them. The success of the enterprise is said to have been so pecuniarily good as to justify the large outlay.

The farmers of both counties admit that they possess good educational advantages for their sons in well-endowed grammar schools, which are for the most part within easy reach.

Only one attempt at ensilage was met with, and that was nothing more than the extemporaneous use of a common storehouse for the purpose of preserving a few green tares that they might be got sooner off the ground to make room for earlier turnips after them.

The American chilled ploughs appeared to be everywhere coming into universal use, and whether on good land or on the lighter soils were always most highly spoken of as great savers of horse and hand labour, and as in every respect more efficient implements than those of the older patterns.

Rents, it is very generally believed, have been reduced some 25 per cent. to 30 per cent. in the last 10 years throughout the county. There is a widely prevailing impression that less meat and corn are produced than formerly, and that in most districts other indications of declining capital are unhappily to be observed; at the same time it was mostly admitted that the year ending in April last had been a decided improvement on many of its predecessors.

In the Table on page 539 as many of the leading statistics respecting the occupations as were freely furnished to the Judges by each of the competitors can be seen at a glance and are arranged for convenient reference and comparison. The number of stock entered in the schedule, as found on the different farms in the summer months, must not be taken to represent in all cases the total number of such animals in possession of the farmers. Some two or three of them had outlying grass-fields, not entered in the competition, and which the Judges did not see, carrying stock which were, or were to be, wintered on the competing farms. The above does not, however, apply to either of the two prize farms.

Again, in all cases the year 1887–88 gave better, in some cases considerably better, pecuniary returns than any preceding ones. It is very important therefore to observe that where

THE COMPETITION.

The following list contains the names and addresses of the competitors in Class I., with particulars of their holdings :—

No.	Name	Address	Acreage A. R. P.	Nature of soil	Sub-soil	Remarks
1	Beasley, Chas.	Harston, Grantham	595 3 18	1 part clay, 3 parts light	Miscellaneous	Highly commended
2	Bowles, T.	Lyndhurst, Mansfield	721 3 21	Light	Sand	Highly commended
3	Brown, W. C.	Appleby, Brigg	611 0 0	Miscellaneous	Limestone and sand	Highly commended
4	Dyson, Wm.	Goldthorpe, Worksop	420 2 12	Sand and limestone	Gravel, sand, and limestone	Commended
5	Faux, J. W.	Coleorton, Ashby-de-la-Zouch	425 0 0	Heavy	Clay	Commended
6	Glossop, W. H.	Forest House, Retford	587 1 6	Light	Chiefly sand	
7	Henson, Geo.	Prestwold Farm, Loughborough	400 0 0	Mixed	Various	Commended
8	Howard, Robt. G. F.	Temple Bruer, Grantham	752 0 0	Light	Limestone	Highly commended
9	Longstaff and Dunham	High Toynton, Horncastle	300 2 29	Light	White clay	
10	Lynn, Chas. R.	Church Farm, Stroxton, Grantham	433 0 0	Light	Rock and ironstone	Commended
11	Machin, Samuel C.	Forest Farm, Papplewick, Nottingham	522 0 0	Light	Bad sand	1st prize
12	Machin, Wm.	Papplewick, Nottingham	839 3 15	Light	Sand clay and rock	2nd prize
13	Martin, Walter	Wainfleet	632 1 18	Light	Silt	
14	Morley, R. N.	Leadenham Old Hall, Grantham	569 0 2	Light and clay	Limestone and clay	Commended
15	Wilkinson, William	Car Colston, Bingham	430 2 30	Light and heavy	Clay stone and sand	

results of the last year only are furnished, the previous ones, if given, would probably have yielded no better proportionate returns than did those earlier ones, of which particulars are given. If this is not remembered, it is obvious that the accounts of those competitors, which include the results of one or more previous years, will be unfairly prejudiced.

The instructions to the Judges of farms have often been given in the Journal, but may nevertheless be once more repeated here :—

In making their awards the Judges are instructed especially to consider :—

1. General Management with a view to Profit.
2. Productiveness of Crops.
3. Quality and suitability of Live-Stock.
4. Management of Grass-Land.
5. State of Gates, Fences, Roads, and General Neatness.
6. Mode of Book-keeping followed (if any).
7. Management of the Dairy and Dairy Produce, if Dairying is pursued.

The Judges are also authorised to recommend to the Council the Award of Certificates to any really deserving persons employed on any of the competing farms for distinguished merit in the discharge of their duties, such recommendations to be accompanied by a certificate of good character and length of service from the competing farmer.

Now it may be said at once that the Judges, as practical men, desire to make no secret of the fact that they have given very great prominence to No. 1 of the Instructions, as being in their opinion of the greatest importance in itself, and as to a considerable extent including some of the others. After making due allowances, therefore, for the raw material on which each competitor had to work, and unless other matters were very unequal, that man had very decidedly the best chance whose general management with a view to profit was the best. Or, in other words, it is the opinion of the Judges that he is mostly the best farmer who contrives to get the utmost possible return out of his land at the least cost, whilst maintaining or increasing its fertility and cleanliness. No undue weight has been given to excessive elaboration, for although it is very pleasing indeed to the eye, is it not the pocket which is in the most need of nourishment, particularly now that we are engaged in such deadly competition with all the greatest slovens of the civilised world? At the same time, of course, it has been by no means forgotten that neatness, order, and good workmanship are but a part of the truest economy in the management of every good farmer.

The Table on page 539 shows the amount of the total receipts under separate headings for each of the farms, and also, in the same way, the expenditure, exclusive of tradesmen's bills and sundries, for as many years as could be obtained, and the net returns per acre.

First Prize Farm.

Occupied by Mr. S. C. Machin, The Forest Farm, Papplewick, Nottingham.

It was plain to all the Judges at their first visit to this farm that it was under no common management, and each subsequent one much strengthened the impression, and they were ultimately convinced that they had never before seen more sound economy and fertility of resource, united with the capacity and the determination to turn every possible opportunity to the best account. Mr. Machin is a great doer, as are all about him; but he is eminently a thinker first, and it became strikingly evident throughout the inspections that there was no detail of

TABLE GIVING PARTICULARS OF STOCK AND RECEIPTS AND EXPENDITURE ON COMPETING FARMS IN CLASS [illegible]

Name of Competitor	Years of which particulars are given	Acreage: Arable	Acreage: Grass	Description of Soil	Cattle including calves in hand in: Feb.	Cattle including calves in hand in: July	Sheep in hand in February	Sheep, including lambs, in hand in July	Number of draught Horses in work	Rent, tithes, rates, taxes, &c.	Paid for wages	Cake, corn, seeds, manure &c., bought	Live stock bought	Corn, hay, potatoes, and like produce sold	Live stock, poultry, dairy produce and wool sold	Gross produce sold from farm during year	Gross produce sold after deducting or adding difference in value of live and dead stock between beginning and end of year	Net produce of farm, less the outgoings particularised	Net return per acre
										£	£	£	£	£	£	£	£	£	£ s. d.
S. C. Machin	1887–8	461	61	Very light sandy	72	6	9	41	10	278	387	688	2,654	655	4,941	5,596	5,596	1,589	3 1 0
W. Machin	1886–7	668	171	Light peat and clay, very various	—	—	—	—	14	608	906	1,413	4,581	771	8,662	9,433	8,500	992	1 3 6
W. Machin	1887–8	668	171	Do.	194	13	1,492	818	14	608	930	1,555	6,095	667	1,2241	12,908	11,550	2,362	2 16 6
R. Howard	1886–8 Average 2 years	730	22	Very light	60[2]	3	830[3]	952[1]	21	—	865	788	None	1,850	1,875	3,725	3,725	—	—
C. Beasley	1887–8	393	202	Stiff clay and	98[2]	106[2]	575[3]	703[1]	12	1,065[5]	1,329[5]	1,027[5]	292[5]	2,249[5]	2,682[5]	4,931[5]	4,931[5]	1,171[5]	1 3 6
		310[1]	91[1]	limestone land	63[1]	47[1]	289[1]	359[1]	10[1]		—	—	—	—	—	—	—	—	—
T. Bowles	1887–8	663	58	Very light, sandy	54	18	1,130[3]	620[1]	17	482	1,088	1,239	1,674	1,069	3,858	4,927	—	—	—
W. Brown	1887–8	500	111	Sand, clay and limestone	123[2]	13	585[3]	627[1]	17	801	986	953	185	—	1,584	—	—	—	—
J. W. Faux	1887–8	235	190	Clay	187[2]	127[2]	377[3]	580[1]	12	1,158[5]	1,030[5]	1,580[5]	312[5]	625[5]	3,478[5]	4,103[5]	—	—	—
		111[1]	53[1]	—	17[1]	17[1]	40[1]	32[1]	2[1]	—	—	—	—	—	—	—	—	—	—
C. Lynn	1887–8	278	155	Mixed soil on limestone	52[2]	54[2]	416[3]	525[1]	8 to 10	562	641	858	294	823	1,504	2,327	2,661	253	12 0
R. Morley	1887–8	287	283	Clay and limestone	190[2]	98[2]	623[3]	734[1]	7	786	571	487	120	948	1,468	2,366	2,510	530	18 6
G. Henson	1887–8	217	183	Good mixed soil, various	93	89	396[3]	545[1]	—	794	540	530	—	—	—	—	—	—	—
W. Dyson	1887–8	252	168	Good limestone	55	54	477[3]	541[4]	9	846	491	—	—	—	—	—	—	—	—
W. Glossop	1885–8 Average 3 years	420	167	Very light sandy	108[2]	124[2]	573[3]	920[1]	13	748	702	1,135	795	1,082	2,293	3,375	3,375	Nil	—

[1] Outlying farms not entered in competition, but particulars necessarily given because accounts of them have been kept in one with the entered farm.
[2] Including several young stock and calves. [3] Chiefly breeding ewes and hoggets their produce. [4] Chiefly ewes and lambs. [5] Both farms inclusive.

his business too small to receive a considerable amount of thought.

The farm is held from year to year, subject to six months' notice, and the tenant is protected by the usual Notts Tenant Right custom. The agreement contains the usual restrictions against what is considered unfair cropping and the sale of certain descriptions of produce, but they are in no way a hindrance in the present case.

The dwelling-house stands pleasantly upon slightly elevated ground, and is well built and comfortable. It is also conveniently situated for the farm, which lies all round it.

Mr. Montagu, of Yorkshire, is the owner of the soil, and the occupation has been in its present hands for 20 years. It was amongst the very last of the Forest Lands to come under the plough, and was enclosed some forty years ago by Mr. Machin's father. The present tenant, finding the fields too large, has since divided them all into an average size of about thirty acres at his own expense. Both the old and newer hedges have planted well, and grow with surprising strength, considering the nature of the soil. They have clearly been well trained from the first, and are kept now in admirable order.

The soil in question is upon the New Red Sandstone, and consists of a very light and sandy surface soil above a greater depth of sandy subsoil. All of it is of a poor and hungry description, and some of it so bad that the Judges do not hesitate to say that, had the farm been to let at the present moment, it would be difficult to find any man of business, and a stranger to the district, who could be got into a second field with a view to hiring it. Many of the hedgerows are billowed with soil which, from time to time, has been blown from the surface of the fields; and indeed the writer saw a field of barley in May which had but just previously been injured from this cause.

The surprise, therefore, was proportionately great to find at the December visit, and in the very dry year of 1887, perhaps the finest crop of swedes we ever saw growing. They were of very great and uniform size, remarkably even in plant, and of quite perfect quality, clear, bright, and almost as fresh in the skin, as the choicest of dessert apples. A great part, if not all, of the crop was estimated to weigh little, if any, short of 30 tons per acre; and Mr. Machin told the Judges afterwards that a measured acre could not be got upon a ton cart 30 times filled. The stock of turnips was chiefly "Lord Derby," which is considered very hardy, and is in general good favour in the neighbourhood. This forest land, when well and generously treated, is clearly much adapted for this description of root, and

otherwise it could not pay the cost of cultivation. The main and much the most important object, therefore, of Mr. Machin, and other good farmers of similar land, is to get a good crop of roots. To this end *all* the home-made manure of the year is always applied straight from the yards; and if it can be said that an excess of energy or any other kind of effort is specially concentrated on any individual item of his work, where all of it absorbs so much, that excess Mr. Machin certainly devotes to the production of good swedes.

About twelve loads per acre of farmyard manure is usually placed on the swedes, and a great point is made of applying it from the yards, where it has not previously been touched, to the ridges at seeding time, although the plan involves a great pressure of work at an especially busy and anxious time. Both the First and Second Prize men are great upon the superior virtues of green manure over that which has been treated in any way; and they are ready with instances in which experiment and observation have proved their contention. They also point with much satisfaction to the evidences of "last" in their green manure, as shown in the many undissolved bits of it to be seen about the land after one or more crops—although there may certainly be two opinions as to whether this particular feature should be reckoned among the advantages or disadvantages of the system. The manure, however, is all made under cover, and comes from the yards, not only in a very rich, but a very well rotted and manageable state. In addition to it 5 cwts. kainit and $1\frac{1}{2}$ cwt. sulphate of ammonia are sown by hand for the roots. Each day's ploughing is drilled before night, to ensure germination in all weathers, and at a very dry time the excellent plan of ridging with a single-breasted plough is adopted, to bring up the moistest soil for the seed-bed. The ridges are 27 inches apart, and sowing commences about May 20. No white turnips or mangolds at all are grown. Directly the young turnips show themselves, a side hoe of Mr. Machin's own invention, which is attached behind the rollers of the drill to prevent the mould from burying the plants, is got to work. The usual L hoes follow next with harrows attached.

Much careful attention has been given to the preservation of all the roots not wanted till after Christmas, as it is very difficult to keep them sound upon the forest land, particularly for the length of time which is there required. The surviving plan after many trials is to open a furrow with a single plough along the side of every double row of roots, into which two rows only are very carefully placed, when the furrow is turned

back again upon them. It is essential that the bulbs do not touch, nor be too much buried under the soil, but just so deeply only that their crowns be fully covered. They are ploughed out again for use, when another ingenious invention of Mr. Machin's, which is attached to the plough, levels down the furrow after the turnips are lifted out to make all safe for the sheep. The writer, although hailing from a county not entirely innocent of swede-growing, will not easily forget seeing this operation in practice some days into May, and the turnips coming out juicy, heavy, and fresh as when they were put in, and after a little root-trimming clean enough for a drawing-room. One-third of the roots are drawn for the bullocks in the yards, and the others are consumed on the land by sheep.

Barley follows, and a splendid crop of it was shown to the Judges in July, as might well be expected after such a preparation as has been described. Barley is sown successfully as late as May 14, and five to six quarters per acre are looked for in favourable years. If a few acres of roots are folded after that date vetches follow, with seed sown amongst them to keep the land in the same course.

The awnless barley is usually grown, as it stands well, and is more inclined to a bolder berry than many other kinds. The sample upon this light land is generally too thin to tempt the maltsters greatly, and therefore a large portion of it, as well as of the oats, are mostly used for home feeding.

Seeds, $1\frac{1}{2}$ peck English and Italian ryegrass, 10 lbs. white clover and cow-grass, and a little sheep's-parsley, are sown in the barley, and left down for a second year. It does not pay to leave them down longer, as they so much deteriorate and become choked with the old forest grass, which is of no feeding value and apparently indigenous to the soil. Upon the two years ley the clovers had died out, and upon the "set," which was seeded with the barley of 1887, they had been killed by the drought, so that very little but ryegrass was left in either case. One field only of the first year's seeds is mown yearly, and none of the second.

Wheat or oats unmanured follow the second year's seeds, and neither of these crops in the present year is a very heavy one. The spring had been too dry for the oats, which were sown upon exceedingly poor fields of land, the worst probably of the farm. What was left of the wheat looked vigorous enough, but it had suffered seriously in plant, in common with almost all the rest seen upon our rounds, particularly upon the lighter soils. One field was mended with barley, which promised, though late, to be very fairly successful.

Very little over 3 quarters per acre are locked for in ordinary seasons.

The wheat stubbles, weather permitting, are all invariably broken and crossed with a narrow share cultivator in the autumn, and in accordance with Notts custom the stubble, and what couch-grass there may be—and some will inevitably appear on this land after two years' seeds—is collected and stacked in the fields, whence it is drawn to the yards for litter in winter. The land is then ploughed clean and deep with the American digging ploughs, of which Mr. Machin has the highest opinion, so much so that he has ceased to use his double-furrow ploughs, and intends to break them up. More ploughing and dragging take place in spring to kill any chance weeds which may still have escaped. It would be difficult, if not impossible, to keep the farm so clear from couch as it is by spring cultivation only, the land running so much to dust at that time. The fallows are limed every ten years, at the rate of three to four tons per acre, and at the cost of 11*s*. per ton at Linby Station, three miles distant. The lime is put on in little heaps and spread when slacked, and no operation is more essential. It improves all the crops, cures "anbury" in the turnips, and keeps down sorrel and other indigenous weeds. Without it the farm would probably be worthless.

The grass land, which lies a little distance from the main holding, together with one field of arable, is also of very poor quality, and is useful only as a change and stowage for young store beasts and for shearlings.

Notwithstanding the very remarkably light expenditure for labour, 16*s*. to 17*s*. per week is paid to full men in these low times, and the price appears to be above the average for the district. Mr. Machin is a great believer in the economy to master and man of good wages, if thoroughly earned, and certainly poor service would nowhere be at a greater discount. Where, as here, master and son are able and willing to illustrate a good day's work by their own example, it is no doubt difficult for the men to shirk it. As an instance of what *can* be done in this way, and for one department only, Mr. Machin's son has trimmed 1,070 yards of his beautiful hedges in a single day. The labourers work from six to six with an hour for dinner, and the teams from six to three.

The schedule shows that Mr. C. Machin contrives to keep his labour bill down to the—as far as the writer's experience goes—unprecedentedly low figure of 15*s*. per acre taking the whole farm, and 17*s*. per acre for the arable land only.

There is cottage accommodation on the farm for four out of the five married men employed upon it. They are very good

homes, containing five rooms each, and are held rent free by the tenants. Five single young men, with wages from 16*l.* to 17*l.*, board in Mr. Machin's own house, and complete the ordinary staff of the farm.

The horses of the farm are above an average for the class of land. They go out to grass in summer, and in winter, besides a liberal allowance of corn, each on coming home from work gets a goodly help from the linseed gruel tub, which seems to be a pretty universal institution in the two counties.

The cattle and sheep are all bought for the farm, and none of them leave it till they are fit for the butcher; for although both Mr. Curtis Machin and his brother, whose farm will be next noticed, may occasionally buy stock on commission for other people, such purchases are not brought home and temporarily fed upon their farms before resale, according to the practice of many ordinary dealers. A foal or two, a calf or two, and pigs only are bred. Some 100 to 150 cattle are generally finished during the winter and spring months, the greater part, if not all of which are the best class of Irish bullocks which can be bought in the autumn at York market, where they come then in great numbers and variety. Upon arrival they have roots thrown them for a time on the seeds, after which they are put at once into the yards. The standard allowance of cake seems to be about 10 lbs. per bullock.

Mr. Machin prefers linseed-cakes, which, as well as all purchased feeding stuffs, are bought forward at the cheapest times. All beasts have pulped roots and straw chaff in unlimited quantities. In the dark mornings of winter the horsemen help to feed them before they can see to work on the land, and again after they return in the afternoon, and nothing is given between. The bullocks appeared to be thriving well, and the practice is common in the neighbourhood, but the Judges thought the interval between meals decidedly too long. Three milch cows only are kept, and their produce sold as butter at Nottingham.

Shearling sheep in fresh condition are bought in May to stock the seeds, and sold as they can be got fit from August onwards. As many half-bred lambs as the farm can carry are purchased from the Norfolk or Peterborough markets, and more afterwards for the turnips if required. Lincoln and Hampshire is a favourite cross, and many of the hoggets seen in December made from 50*s.* to 54*s.* out of their coats, and the lambs in the following July were bought with much judgment. If the trade is good the sheep are cleared off by the end of turnips in May. But as barley can be sown as late as May 14, when the seeds should be ready for stocking, the sheep are sometimes put on

them for a short time, and the calamities which occasionally befall those who are forced to sell at a time of full supplies between the two periods of turnips and grass feeding are thus avoided. The sheep get daily ½ lb. cake and ½ lb. oats, besides hay chaff and malt dust. The turnips are cut for the sheep in November, and given in unlimited quantities.

Mr. Machin has a capital stock of both Berkshire and Lincoln pigs, of which he sells some both pure and crossed at good prices. Bacon also is sold. The Berkshire pigs are killed for the house and packed in salt, the bottom pieces being brought to the top, and *vice versâ*, once a month. The bacon is then hung up to dry before packing in oats, where it is said to keep very sweet, dry, and good for any possible length of time, and the oats are not injured by the process.

Fowls are a most important item of the live stock of the Forest Farm. The return from them last year was 67*l.*, but probably next year it will be much more, because of the great success of a new incubator by Hearson and Christie, which has replaced a very inferior one previously used. This very capital artificial mother had hatched off 500 chickens in early July as fast as it could act, and without a check of any kind, and all of them were the very picture of health and thrift. The temperature is regulated by a most ingenious self-acting arrangement, which shuts off the heat when a proper degree of it is reached, and thus obviates the great danger which besets most incubators. The young chickens are generally fed with wheat dari and oats, and those of early spring are sold for 5*s.* 6*d.* to 6*s.* 6*d.* a pair. In the autumn and winter they make 7*d.* a lb. to private customers in Nottingham, and the breed is so good that 16 lbs. is not an uncommon weight for a couple of them. The eggs are supplied from seven fowl-houses on wheels, which have been made at home from old carts or vans, and boarded in and properly fitted for the laying hens. Each contains when desired a separate breed, or a cross between them, of 50 or so in number, and the houses are drawn from field to field about the farm, to secure the healthiness of a new run, and to give the fowls an opportunity of living principally upon the worms or insects which are useless or injurious to the farmer. As the fields are cleared after harvest, of course they are taken to pick up the leavings there. The eggs are gathered by the younger sons before and after school. A favourite cross is Plymouth Rock with Langshan or Dorking. The pigeons yield 19*l.* a year, besides seven loads of manure from them and the fowls, which is also carefully treasured for the roots.

Upon the premises there is a place for everything and every-

thing is in it. The Judges were repeatedly assured that no departure of any kind from ordinary custom had been made for their visit, and they had no difficulty in believing it. But the great feature of the farm buildings is undoubtedly the two covered yards—or rather semi-covered, for Mr. Machin thinks the stock are more healthy when not quite roofed in, and there is more facility for carting in their litter. The roofs to the yards are of a new design, at least to the Judges, but the first of them was put up, it seems, some fourteen years ago, and has stood well. They are now spreading with great rapidity over Notts and Lincoln, as we had the opportunity of seeing. The chief merits claimed for them are cheapness and superior ventilation. The roofing is entirely of wood, $\frac{1}{2}$-inch deal being used as a covering, each board of which is nailed from ridge to eaves, but leaving, oddly enough, a small space between each of them of $\frac{1}{16}$ to $\frac{1}{8}$ of an inch, which widens in dry weather to at least $\frac{1}{2}$ an inch. The boards are grooved at each upper edge to make small gutters to carry off the rain, and very little indeed of it comes inside, because, it is said, of an upward draught, which drives the water into the grooves, unless the fall is exceedingly heavy. The wood is never tarred or otherwise preserved from the effects of the weather, first, it was said, because it does not want it, and secondly because it would interfere with the free flow of the water. The suggestion by the writer of a creosote bath for the boards was rather strongly approved in one or two cases.

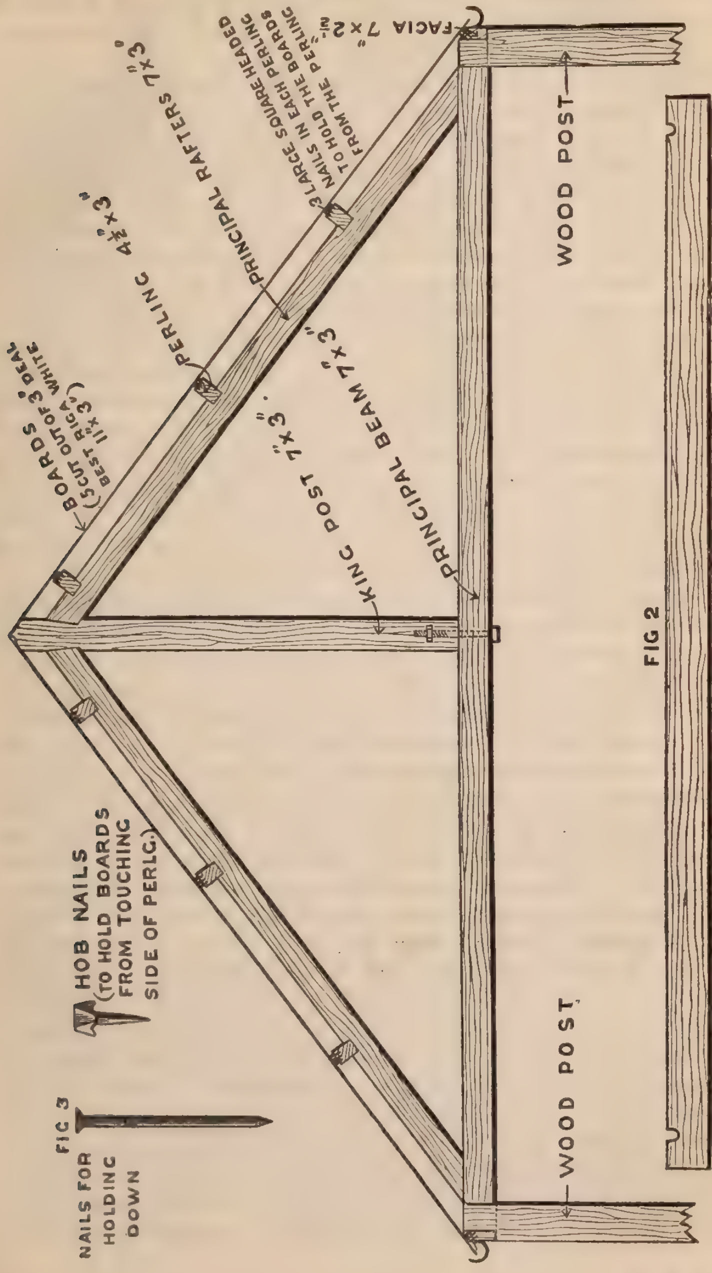
Mr. Machin's yards were covered by contract at 2*s*. 8*d*. per square yard of them—not of the roof. The price does not include supporting fronts, which are not necessary unless the space is too wide for a single span. At the figure given, which could probably be reduced in many cases, the saving in straw, in warmth and comfort to the bullocks, in labour—for half the quantity of straw carted in and out is certainly of more value than double the quantity of washed-out manure would be—should cover the cost in a very short time indeed. As the design is probably a novel one to most farmers, and may be considered worthy of imitation by tenants as well as landlords, details are given in the woodcuts on page 547.

Wooden posts for supporting the shedding are shown in Fig. 1, and must obviously be employed at the junction of eaves where a double span is necessitated. But where the width of yard can be bridged by a single span, sufficient support can often be obtained without the posts by junction with existing buildings.

Fig. 2 is a section of a roofing board to show grooved gutters, the boards to be affixed $\frac{1}{16}$ to $\frac{1}{8}$ in. apart.

One long nail (Fig. 3), which fastens the board to the perling, is used to every hob-nail, and is driven through as closely as possible to it.

Details of Covered Stock Yards at Messrs. Machin's, of Papplewick.



Willcock's cattle mangers of glazed earthenware, $2\frac{1}{2}$ ft. long by 2 ft. wide, price 6*s*., set in brickwork, are carried round as much of the wall space as possible, and it is difficult to imagine anything cleaner or more durable.

There is a powerful and excellent 12-horse power fixed engine on the premises which Mr. Machin bought second-hand at a very low price, and his son—who seems to inherit plenty of his father's intelligence with quite a genius for practical mechanics—soon converted it to its new requirements. He has also contrived a pipe to warm with the waste steam the water which supplies the boiler, as well as other ingenious and economical improvements. The steam-power is used for pulping roots, cutting chaff, and grinding corn and cake, and the different machinery is so arranged and mechanically assisted that one man drives the engine and sees to the mixing of roots and chaff, whilst another feeds both the chaff-cutter and the mill. A boy outside to fill the shoot to the pulper with swedes completes all the requirements. A small quantity only of roots is got up at once to avoid a second moving. Mr. Machin shares a portable engine with his brothers for thrashing purposes. There is a very fine Dutch barn in the stackyard built upon brick piers, a building which seems to be very common upon this estate.

There is a blacksmith's and carpenter's shop on the premises to which a blacksmith comes about one day in each week, and a carpenter one or two. The work of these men, with the oversight and assistance of head and hand supplied by both master and son, appears to keep the tradesmen's bills down to a very insignificant and enviable item indeed. It is in this way that a new sheep-dipping apparatus, with tub, dripper, cradle to hold the victim in a standing position, and lever to raise and lower it complete, has just been made. By it some 500 sheep are dipped in a day, with the help of three men and a boy, at a cost of 1*s*. a score. Thence emanated also a great number of ingenious and labour-saving contrivances for the farm, of which a few only can be named. One of them is a drill affixed to the ordinary presser, in which all light land Nottinghamshire farmers have very great faith. It is used for all crops after seeds immediately behind the ploughs, and presses the turf into deep grooves, into which the newly invented drill deposits the seed instead of broadcast-sowing as previously. Harrows also fastened to the presser follow the drill, which being made of sufficiently extra width, complete the whole work of rolling, seeding, and harrowing three times in a place at one operation. From the same source was turned out an elevator which, fixed to the hind part of the dressing machine, raised the corn into sacks without extra

labour, an improvement Mr. Machin claims to have had in use before the machinists thought of it. A very neat little rail and trolly arrangement was also noticed for placing under the gardener's turnip-cutters in the fields in which the hods were run in and out to fill and carry to the sheep. It was said to save the bottoms of the galvanized pans to an immense extent, as well as to facilitate labour, and as one man grinds all the turnips required for the entire flock of sheep, no doubt he is glad of all the mechanical assistance he can get.

In the blacksmith's shop were shown some all-steel bars for shoeing the farm-horses, which came ready grooved for use, so that the smith has only to turn them to shape and punch the holes before fitting to the horse's feet. Although very light, they are said to last much longer than the ordinary iron shoes, and the steel costs 9*l.* 10*s.* per ton.

Very few new implements seem to be bought, but advantage is taken of every opportunity to buy other people's failures or castaways cheaply, when it is seen that a little ingenuity and work of head and hand will turn them to profitable labour-saving account.

Mr. Machin has built at his own expense a little malt-house and kiln, which probably he originally intended for malting the large quantity of barley he gives his stock, as also to supply the raw material for the beer which is all brewed at home, or for drying corn, wool, or other produce requiring it. As, however, experience seems to have made Mr. Machin sceptical of the superior advantages of malt over raw barley as a food for stock—in which, as in several other like conclusions, he is quite in accord with the most approved scientific opinions of the day—the kiln is seldom put now to the former purpose, although it is of great service for the others.

The very extensive and powerful waterworks of the Nottingham Corporation are situated on the farm, and from them water is laid on to the dwelling-house, premises, and every field of the occupation on its way to Nottingham. It would be difficult to estimate the importance in economy of labour alone of this convenience, to say nothing of the benefit to the stock of a never-failing and ample supply of pure water in so dry a spot. There are stone receivers and a meter at every outlet, and there is a small charge per 1000 gallons, amounting to the insignificant sum, in comparison with the benefits, of about 12*l.* a year. But this is only paid under protest, there having been, it was said, an original provision by which in return for certain conveniences the water should have been delivered free. Mr. Machin has laid down some of the delivery pipes at his own expense. Long

lengths of ordinary firemen's hose are kept coiled up near the house for fixing to a convenient hydrant, whence there is pressure enough to send the water to any part of the buildings. The arrangement would of course be of great service in any outbreak of fire, and pending this it is turned to a great variety of practical purposes.

Mr. Machin keeps no very elaborate accounts, and, therefore, could produce no exactly stated balance-sheet. All sales and purchases are, however, carefully recorded, and they, as well as other figures which were given, will be found in the schedule of all such particulars. No accounts were forthcoming of any previous years, but there was offered in other forms the most ample evidence to show that Mr. Machin has no reason whatever of a pecuniary kind to regret his choice of a business, hard times notwithstanding.

Second Prize Farm.

Occupied by Mr. William Machin, Papplewick, Nottingham.

The First and Second Prize-men, rather curiously, are brothers, living in the same parish, and their methods of cropping and tilling their land, of buying and feeding their stock, in fact of management generally, are so very similar, that having entered rather minutely into the practices of Mr. Curtis Machin, it would be in great part a needless repetition to give the whole of those of Mr. W. Machin.

In speaking of the latter, therefore, where nothing is said to the contrary, it is to be assumed that his practice is the same as that which has been already described.

Mr. W. Machin occupies a good modern house, which, however, is situated too much at one corner of a rather straggling farm, and too near the village street, for quite an ideal position.

But certainly the number and the conveniences for stock and crop afforded by his premises are enough to excite the admiration and envy of many of his less fortunate brethren. Thus, besides home premises, he has two sets of conveniently situated field-buildings, with a substantial and commodious Dutch barn at each of them; and there are two Dutch barns at home. Then there are no less than six covered yards for his grazing beasts, three at home and three at the off-premises, each of an average area of about 25 yards by 20. At two out of the three sets of premises there are fixed engines for chaffing the straw, pulping the roots, and grinding the cake. At the third, a mill for grinding the corn is driven in addition by water from a fine stream which runs through some of the meadows. All

the corn for the stock is ground here—to the quantity, sometimes, of 500 quarters in the year.

At the May visit, the whole of the yards were full of a very superior class of Irish cattle, 168 in number. Indeed, they were more than full, for each bullock had to be content with 17 square yards of space. Yet there was no sign at all of restlessness or of driving amongst them, and they could scarcely have been quieter if in separate boxes, though it is true they were not seen at feeding time. Mr. Machin accounts for this superior amiability and content as resulting from his practice of sawing off the tips of the animals' horns.

The cattle were of great size and weight, and particularly ripe for the time of year. In fact, the impression could not be resisted that they would have paid better if sent to market before. This opinion was subsequently strengthened by working out, approximately, the weekly returns of these beasts against those of Mr. Curtis Machin, who had sold sooner, when it appeared that the latter gave about 12*s*. to 13*s*. gross gain per week and the former 9*s*. to 10*s*.

The roots on this farm were perhaps even superior to those of the brother, and an extraordinary quantity of stock were kept upon them all through the winter. There were over 1,400 grazing-sheep still eating ground swedes at the May visit, all in the same fold, and taking the whole field before them. The practice of feeding so many together was, however, by no means commended. A small army of boys under the direction of a man were cleaning and heaping the turnips, and attending to the wants of the sheep, just outside the advancing hurdles.

The soil of Mr. W. Machin's farm is some of it very light, and other is of a poor peaty character. Yet it is mostly of a cooler subsoil, and in the opinion of the Judges on the whole decidedly superior to that of Mr. Curtis Machin. They were on this account a little disappointed not to see some of the growing crops a little heavier than they were found to be at the July visit, and a little freer from annuals and weeds of a longer life. The corn also seemed very backward, and no doubt the late season which had kept it in check gave the annuals a chance they would not otherwise have had.

It is only fair, however, to say that some 400 acres of this farm were taken by Mr. Machin only four years ago, and as the Judges were told, in a bad condition, which circumstance could hardly fail to place him somewhat at a disadvantage. But unfortunately a greater disappointment awaited the Judges in the appearance of the young turnips, which were the most backward they had seen, and rather stunted and weak of plant. No doubt

they may make a tremendous start when they get down to the lavish dressing beneath them, but all the same they had clearly been losing valuable time, and it could not be forgotten that they were *the* crop of the farm. Mr. Machin had been so unfortunate as to follow a practice, which however good in a moist time is very dangerous in a dry one, such as was experienced in the present spring. He had allowed the ploughs to get a good deal ahead of the drill, and when sown the turnips could not germinate. Whilst sympathy was felt with the reasons given for the practice, and their weight acknowledged, it was yet found impossible to commend it. The reason of the plan was, the immense pressure of horse and hand-labour entailed in hauling so many tons of manure upon the land, and getting the whole work of the turnip sowing completed within the short season which had been found the best for performing it. Hence, in order to forward the work, the dung hauling is begun before it would be wise to sow the turnips. If when the time for sowing comes the weeds have made such a start as to threaten to outgrow the young turnips, Mr. Machin has hit upon a very ingenious method of stopping them. It is a hoe or scraper shaped to the ridge which precedes the drill and lightly shaves the upper surface of the mould. But ingenuity notwithstanding, the turnips in the present instance had not been able to germinate, or at all events to grow healthily, and other competitors had solved the same difficulty successfully.

There were but fifty acres of wheat on the farm, and a good deal of this was after roots, oats mainly following the second year's seeds.

The permanent grass is chiefly of a very secondary or mild character, and is mostly pastured with lambs, of which about 1,000 are usually bought.

The team-horses are very superior animals, of great size and substance, and few, if any of them, are much over five years old. That a great deal of just pride is centred here it was very plain to see, and the cart-horses, as well as others of a lighter class, which are bought or bred on the farm, are clearly hobbies of Mr. Machin's heart in more senses than one. Whenever a promising young animal is to be picked up reasonably, it is bought and put to grass and corn. At four years old all the purchases are taken into the teams in place of as many five-year-olds, which are sold. Mr. Machin calculates that this system of perpetual change not only avoids the gradual depreciation of all-round value, which afflicts the like property of his neighbours, but nets him an average profit of 10*l.* per horse besides; which it certainly ought to do considering the judgment and capital

employed, and the risk and trouble it involves. The produce of five or six cows is sold as milk in the village at 10*d*. a gallon.

Although the adjacent collieries are no doubt the cause of higher wages, they are made helpful in a way to the labour bill. It appears that boys are refused employment underground until long after an age when they are very useful on a farm. There is consequently a pretty good supply of available youngsters, of which advantage is taken, and a number of them are put with a man.

Mr. Machin's son acts as his deputy in his absence, and the daughters very efficiently and cheerfully assist Mrs. Machin in the domestic economies, and with the fowls, &c., preferring to dispense with much hired service in the house. As no men are boarded in the house, the work, it may be hoped, is considerably lighter than that which appeared to fall upon the shoulders of Mrs. Curtis Machin.

Water is received here also from the Waterworks for some of the premises and fields, at a charge of 4*d*. per 1,000 gallons.

The figures of the farm accounts, shown on page 539, speak pretty eloquently of good management, and if this is accompanied by a trifle less of the extraordinary economy, the versatility, and the mastery and strict supervision of minutest detail of the winner of the First Prize, the difference may be owing to other duties of Mr. W. Machin as sub-agent to his landlord. His farm is also upon the estate of Mr. Montagu, and both the brothers speak in the highest and warmest possible terms of their relationship with him. Mr. W. Machin's son has kept very strict and careful accounts in a proper and businesslike way for the year 1887–88, which stood a pretty close analysis, and the figures on the schedule may be supplemented here by saying that the net balance of the year, when *all* the expenses of the farm are duly charged, amounts to the astonishing sum of 1,800*l*. For the previous year it was 600*l*., and the accounts were less satisfactory. It was the first attempt by father or son at anything of the kind, and it was the opinion of the Judges that some items of expenditure had been less carefully recorded, and consequently that the balance should have been rather less. In both cases, however, valuations had been made at the beginning and end of the year.

Of course the capital employed is very large, and there is no charge for interest against it in either case. Then it should be remembered that the last year was in many ways peculiarly favourable to the main business of this farm, viz. the manufacture of meat. For instance, store stock were bought at unusually favourable figures. The price of all feeding stuffs was exceed-

ingly low. The crop of roots was extraordinarily heavy, when in many other counties there was a very small one or none at all. Both mutton and beef were scarce, and sold well when the stock went out. It should be stated too that the great weight of roots was not, as is so often the case, peculiar to one or two fields, but was common to the whole farm.

Both the Messrs. Machin have, in an extraordinary degree, that knowledge of stock and of the market which is essential to the success of their particular system, and if they are not exactly what some would call scientific farmers, they have so far gone to the bottom of things that it might puzzle some very keen professors to suggest a profitable improvement.

As an instance of their union of practice with science, or, as the latter word simply means, with knowledge, it may be instructive to give their own account of their reasons for changing the four-course rotation of cropping, which they practised some fourteen years ago, to the five-course—or two years' seeds—which they practise now. In the first place it is because turnips, and particularly swedes, every four years was found to be too often for the capacity of the land. Next because the greater quantity of fibrous turf—organic matter perhaps the chemists would call it—which came up with the two years' ley helps such light land to retain moisture, as well as nourishes every description of crop. Again, a less acreage of corn is preferred because the land either does not grow full crops of it, or grows them of poor quality, whilst it does grow all green crops well, and the excess of grass does greatly assist in keeping down the annuals, so that less weeds are found on the fallows than there used to be with more frequent ploughings. Wheat is scarcely worth growing at all at present prices on such land. By delaying the corn crop another year much better crops are grown, and the good offices of the manure merchant, which may be needful enough elsewhere, and upon land requiring a different system, are held very much at a discount. And lastly, though by no means least, the labour bill is greatly reduced by the change from the four- to the five-course shift.

It may also be pointed out that when artificial manures are used—which is almost entirely upon roots—the Messrs. Machin select them scientifically, that is to say, they discard what they do not want, and yet that which is so omitted is just what would first of all be recommended to them if they took the manufacturer's advice—namely, phosphates in some form or other. Indeed, one of the most curious facts about such wonderful roots on land of this character is that they were grown entirely without artificially supplied phosphates, all land mostly requir-

ing this manure for the purpose, and such land as this in particular. That it was right to withhold them is clearly proved from the results, which could hardly have been better with them.

The problem seemed to the writer sufficiently interesting to see what science in high places could say towards its solution, and a sample of soil taken from a field typical of both the Messrs. Machin's farms has been obligingly analysed by Dr. Voelcker with the following result :—

Sample dried at 212° F.

*Organic matter	2·19
Oxide of iron	·83
Alumina	1·48
Carbonate of lime	·57
Sulphate of lime	·31
Magnesia	·40
Potash	·28
Soda	·15
Phosphoric acid	·22
Insoluble silicious matter	93·57
	100·00
*Containing nitrogen	·12
Equal to ammonia	·15

Total lime (CaO) . per cent. 0·45, equal to carbonate of lime, 0·80
Sulphuric acid . 0·18.

(Signed) J. Augustus Voelcker.

Dr. Voelcker entirely supports the opinion of the Judges as to the exceedingly light, sandy, and poor character of the soil mechanically. He also adds that the amount of phosphoric acid is decidedly high for such a soil (yet scarcely so high, the writer ventures to think, that Dr. Voelcker would go the length of advising no application of superphosphate for the root crop); and that the potash is also high, whilst the organic matter is extremely low as compared with average soils, and low even for a sandy soil (a further justification of Messrs. Machin's practices as previously explained).

But not only do the Messrs. Machin discard the usual, and, in their particular case, the useless in artificial manures, but they supply the unusual in very large doses of potash as kainit, and of nitrogen as sulphate of ammonia. In feeding stuffs, again, Mr. W. Machin is a great believer in decorticated cake, which, when it can be got soft and good, science agrees with him in believing to be a good material to mix, as he largely mixes it, with corn. As much, therefore, of artificial assistance as can be employed profitably seems to be taken advantage of, and great discrimination is exercised.

It has been more than once, and very naturally, suggested that the good roots of the Messrs. Machin must have been largely due to an excess of rainfall in their district over that of others. The rainfall of the summer months of 1887 in the neighbourhood of Papplewick was therefore requested of Mr. J. D. Walker, of Bulwell, and most obligingly furnished; a similar record has been also obtained from Appleby, Leadenham, and Harston, or their neighbourhood, by the kindness of the competitors at those places. In each of these three latter districts, there was more or less difficulty in securing a plant of swedes in consequence of the drought, partly perhaps because of later sowing.

Particulars of Rainfall from April 1887 *to September* 1887.

In neighbourhood of	Papplewick	Appleby near Brigg	Leadenham	Harston
	Inches	Inches	Inches	Inches
April	1·08	1·22	·81	1·05
May	1·42	1·40	1·76	1·89
June	·39	·04	·27	·57
July	1·39	1·44	1·36	1·01
August	1·58	1·46	·66	1·43
September . .	2·43	2·51	2·02	2·70

Before quite taking leave of the Messrs. Machin, it may perhaps be allowed to anticipate a remark which other Judges have heard before, namely, that it is the self-supporting farms which should be encouraged. That is, those, presumably, where the stock are bred and reared as well as fed upon them; and the present Judges would have been glad to have been able to do it. They, however, believe first of all in the men who most successfully adapt their practice to their situation, rather than their situation to any preconceived notions of correct practice. After all, surely it is the banking account which requires support, and if any one can tell the Messrs. Machin how to improve it by other practice than that which they now pursue, it may be confidently predicted that they will be found both able and willing to adopt it.

A sketch of the principal features of the prize farms has now been traced, but there are such very strong points of merit in the management of some of the less successful competitors, which would have been well worthy of a prize in the absence of anything better, that they cannot be passed by unnoticed.

Commended Farms.

The occupation of *Mr. Robert G. F. Howard, of Temple Bruer*, gives much evidence of first-class management. It was about

the last remaining portion of Lincoln Heath to be enclosed, and the land is quite as light and poor as might be expected from that circumstance. The skill and capital expended upon it, however, are quite worthy of the best land of the country. The hedges are admirably kept, and would be very good but for the large number of overhanging trees, which are a great detriment to them and the crops. Mr. Howard had, we believe, almost the only large break of fully-planted swedes in his neighbourhood, but they were by no means so big as those of the Messrs. Machin; nor do we think the land would grow them so in any season, although the soil looks very similar. The land was clean on the whole, though not entirely free from very small pieces of couch, which it would be very difficult to remove altogether from such dusty soil. The house, garden, roads, yards, premises, and buildings were faultlessly kept, and with no appearance of temporary effect. The wheat was thin, as everywhere else, but the barley excellent for the land. The pride of the farm, however, is the splendid flock of Lincoln sheep which was started by Mr. Howard in 1849 from the oldest and most noted strains. No expense has since been spared in selecting the best males from the first Lincoln breeders, and Mr. Howard's rams meet a good foreign and home demand at high prices. Several have made 30 and 40 guineas, and 60 guineas has been reached. A hundred are sold every year, and those which we saw in July were a grand lot of sheep of very unusual size and substance.[1] Mr. Howard also breeds all his cattle from a valuable old strain of Lincoln reds in much demand, and is very successful too with young blood stock, sired by good stallions, the use of which is granted on favourable terms by Mr. Chaplin, for whom Mr. Howard is agent.

It would be difficult also to speak too highly of the management and appearance of another forest farm, namely, that occupied by *Mr. Bowles, of Lyndhurst.* The premises and all the surroundings, the hedges and gates, and all pertaining to the farm, were models of neatness and good order which nothing could at any rate excel. The crops, too, were very good for the land. The young turnips looked remarkably well in July, and the full-grown ones in winter and spring were almost, if not quite, as good as those of the Messrs. Machin. The general system, too, is similar to theirs, the chief exception being that a

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[1] The Judges had great pleasure in recommending to the Council for a certificate and gratuity Mr. Howard's shepherd, Thomas Clay, who has been a very valuable and competent servant to him for twenty-seven years, and his yardsman, George Hayward, who has been in Mr. Howard's service for twenty-five years.

flock of ewes is kept at Lyndhurst. All the tillage of the farm, which is beautifully clean, is done in first-rate style. Liming is largely practised, and gas-lime at a less cost is often used with no ill effects when sufficiently exposed to the air. Much of the land is very light and poor, and seeds are so very precious that they are often sown without a crop to ensure a better plant. The hoggets were of a saleable description and of great weight in the spring, although Mr. Bowles has much contempt for high-priced rams, being perfectly content with any half-bred sheep—of the Norfolk or similar cross from which he breeds—with sufficient colour of face and plenty of size and substance. The draught horses are, perhaps, as good as could be found anywhere upon land of a similar class, and some are bought and sold again at good prices. Some very fine Lincoln bullocks were grazing in the yards in the winter. It was clear that Mr. Bowles' heart and great energies were very much in his work, and that precision and efficiency were thoroughly enforced in every detail.

Mr. Beasley, of Harston, who is a land agent as well as a farmer on his own account, occupies another of the farms we had the pleasure of highly commending. His house is charmingly situated at the edge of a deep and pretty valley which skirts a part of the farm. From the opposite side rise the well wooded heights so magnificently crowned with the imposing pile of Belvoir Castle, and the whole neighbourhood is hilly and picturesque in the extreme. Mr. Beasley's land is on three different levels, with a difference of some 500 feet between them. Rather less than two-thirds of it is a rich, red, light or mixed soil upon limestone rock, and occasionally, perhaps, a little too near it. The other third, or rather more, is a very stiff and hungry clay, chiefly hanging on the steep side of a valley. The greater part of the latter is being gradually laid down to grass, by the help of the landlord, as the least of evils for them both, and we never saw a cleaner, or in any way better, preparation for young seeds than on one of these stiff and awkward fields in May. The red land grows capital corn, and the annuals, which are a great trouble amongst it, are kept down by a very diligent hand-hoeing, every acre of wheat and barley being so served. Couch is so well under that digging the stubbles in the autumn is practised. Farmyard manure is ploughed into the stubbles in the autumn for roots, and all the tillage is well performed. Potatoes and mangolds are taken after barley, which follows roots, other barley following wheat, the rotation being a seven-course one.

The great speciality of the farm, however, is the success of

the young seeds, which are sown in a somewhat novel fashion without a corn crop. The land which has grown potatoes and mangolds is seeded in the following spring with 4 lbs. red clover, 4 lbs. cow-grass, 4 lbs. trefoil, 1 peck Italian ryegrass; and 4 lbs. rape seed is drilled with them. In some part of June following the mixture should be quite fit for stocking, and at a time when the earliest fed (second year) seeds are getting a little bare for lambs, and they begin to want a suitable change. The rape affords a little shelter for the young clovers, and though not eaten by the sheep upon first entry is fed down readily enough when the sweeter grasses have been closely bitten, as Mr. Beasley says they ought to be. When all is fed as bare as possible, the sheep are moved to another field to allow the first to freshen. The seeds are, of course, left to a second year, when they are mostly mown, and extraordinary crops of clover hay are taken. The Judges were much impressed by the rich and strong appearance of the young seeds in the later days of June of a very unfavourable year for them, and believe that upon land so suitable for the purpose, upon which no doubt success mainly depends, the system is a very valuable one. A flock of ewes provides all the sheep required for the farm, and calves are bought or bred for rearing.

Mr. Beasley keeps very careful and accurate accounts, but takes no valuation at beginning or end of each year, the number and weight of live and dead stock being, he says, about the same always at these periods, and he does not see the advantage of estimating from time to time the fluctuations in their value either one way or the other. He adopts the encouraging plan of giving his workpeople a bonus, or a percentage, on his profits, after deducting five per cent. interest on capital, and they are to be congratulated at all events on the results of the last year. The three previous years unfortunately show balances on the wrong side; but Mr. Beasley is certainly not alone in that experience, and the loss is put down in great part to the heavy weight of some fresh land taken four years since in poor condition, which is only just beginning to give a reasonable return.

The back accounts show good returns upon the home farm before the outlying land was taken in hand. The accounts of the entered and non-entered farms are unfortunately kept as one, and are quite incapable of disentanglement, hence all are given together. The unentered land was seen as well as the other, and the excellent crops upon it showed that effort and enterprise were beginning to tell. It is worthy of notice that if the interest received by Mr. Beasley upon his capital has not always been very large, neither has the principal been large

either. To have taken 1,000 acres of land, as Mr. Beasley's accounts show that he has done, with a total outlay of some 6,000*l.*, whilst maintaining or improving its cleanliness and fertility, seems in itself to be a very creditable performance.

The system pursued by *Mr. Brown, of Appleby*, differs very much from that of other competitors whose farms have been noticed, but there is much that is highly commendable about it. Mr. Brown seems to be thoroughly possessed with the commercial spirit. He is one of those men, not perhaps so commonly met with amongst farmers, who are ever watchful, and ready to turn to good account any possible venture, old or new, which may offer a reasonable chance of success. Alas that there should be so few opportunities of profitable departure from the ruts of our forefathers! Mr. Brown grows potatoes, celery, or anything else likely to answer his purpose, for the London or other markets. It is to be feared that potato-growing is being considerably overdone, but Mr. Brown has convinced himself from past experience that he can hold his own against ordinary competition, by reason, for one thing, of the nature of his soil. It is of good staple, and above the limestone, or, in other places, of a sandy subsoil, and well adapted, under proper cultivation, to produce not only a good weight of tubers, but roots of such quality as will always command a preference in the market. That the risks are great, the fluctuations in the receipts of past years abundantly prove; but Mr. Brown is keenly observant, and humours popular fancies for new varieties, and so forth. But in any case the expense of the crop is more certain than its lucrative returns, and when it is planted so extensively as Mr. Brown plants it, everything else on the farm has at times to give way to its requirements. No less than 100 acres of land are under potatoes at Appleby, and the Judges were much impressed at their July visit by their general appearance. The land might be called in perfect tilth and cleanliness, and the crop was of the utmost promise. It had received 15 loads of home-made or purchased manure, 2 cwts. sulphate of ammonia, 1 cwt. muriate of potash, and 4 cwts. of superphosphate per acre, and the system of cultivation, which perhaps it is hardly necessary to describe minutely, is conducted on the best and most improved principles.

The growth of celery is also being extended, and the expenses necessary for its successful cultivation are much greater even than that for the potatoes. Some measure of the skill which is applied to it may be gathered from the fact that 13 roots of it, taken from an ordinary field row, weighed 58 lbs.

Sheep are bred on the farm, and the management of the ewe flock is very enlightened and successful. More attention was

paid to diet and other careful treatment than was customarily met with elsewhere.

The corn crops were good, particularly the wheat after potatoes, which was the best that had been seen off the stiffer soils. The Judge who visited the farm in May was pained to see the number of hares which were injuring the crops of so excellent a tenant—whose family had occupied the place for four generations—and could not forbear some expressions of surprise. Mr. Brown was, however, very reticent upon the subject.

Mr. Faux of Coleorton is a well-known breeder of pedigree shorthorn cattle, and at the first visit of the Judges to the farm he had selected for competition, out of three in his occupation, they found upon it the astonishing number of live stock which is given in the schedule. It turned out afterwards, however, that the entered farm was worked in conjunction with one of the unentered ones of 164 acres, which is situated within easy distance of the principal homestead. The accounts also of the two farms—so far as any at all could properly be said to be kept—were inextricably mixed, and no satisfactory figures of any kind could therefore be arrived at without taking the two farms as one. The number of stock per acre will be found very large indeed, even when the extra land is taken into account, but not greater, we were assured, than had been previously kept. It was clear that such numbers could only be reared and fed by the very great outlay on supplemental food, and in labour which Mr. Faux seems to think it profitable to expend. All the cattle are bred upon the place, and the number given includes a fine herd of 70 milking cows, of which several have proved their quality, or that of their descendants, in the show yard.

Mr. Faux has won several first and second prizes at Birmingham for young bulls, and out of 15 bull calves which were seen in December, 9 averaged 42*l.* each there in the present spring. The heifers, of which we saw and greatly admired some capital specimens, seem to meet a good home and foreign demand. Price is little studied in the purchase of good sires, and all the young stock were in admirable condition. Everything, including some excellent Tamworth and Yorkshire pigs, not sold for stock purposes is finished for the butcher. A flock of 143 well-bred Shropshire ewes is kept, and the produce grazed on the farm.

The farm buildings are of the most miserably inadequate and ancient description, and old barns and stables and all sorts of curious sheds and outhouses are utilised as cover from the weather. The overflow from them is wintered more or less in the grass fields, which comprise nearly half the area of the entered farm, to which pulped roots and chop, together with

generous allowances of artificial foods, are sent in carts. The sheep in winter are also fed in precisely the same manner.

The land is heavy with a clay subsoil, and *all* the roots—entirely swedes—are drawn and clamped for carriage at leisure to the pulping and mixing houses. Of these there are two, one at the home and one at the field premises, and a fixed engine at each does this work and all the chaffing and grinding. A large portion of the corn grown on the farm is fed to the stock, and does not figure in the enormous outlay given under this head. The grass land is of an inferior character, some of it being much given to hassocks, and this, it was plain, would be of very little feeding value without the amount of artificial food which is used upon it. The occupation is just on the borders of Leicestershire, and the local six-course rotation of cropping is adopted upon it, viz., turnips, barley, seeds, seeds, oats, and wheat. The swedes were good, as they had need to be for the mouths they had to feed; a sixth of 228 acres not being a very large area of them. The corn crops looked promising, without being so extremely heavy as might have been expected from the rich droppings of so many highly fed animals, which, as the land was nicely clean, does not perhaps say very much for the inherent qualities of the soil.

The produce of the 70 cows is manufactured into Leicester cheeses of very good quality. In the course of initiation into some of the mysteries of this art, a great effort was perseveringly made, with the cheerful if not very exact assistance of Mr. Faux, to arrive at the gross return per cow per annum from a good example of it, in order to compare the results with those from the sale of milk and of butter. With no really precise figures to guide one but the number of the cows, and the total weight of marketed cheese, it is to be feared that only an approximate estimate was obtained from our laboured efforts. The inquiry was rather complicated by a number of difficulties concerning some milk used for other purposes, &c., and chiefly by the uncertain value of the waste or secondary products of cheese manufacture. However, the conclusion ultimately evolved was that Mr. Faux's cows, which are good milkers for pedigree animals—if the writer may be forgiven an apparent but of course unintentional reflection—yielded him 12*l.* per cow besides a valuable calf. One of the Judges who sends his milk to London was of opinion that he obtained 11*l.* 10*s.* per cow by this means, also irrespective of the calf. Too many people are conversant with average yields of butter per cow to make any estimate of it at all necessary. But the cheese-maker has one important point in his favour which must not be

forgotten, namely, that he makes his commodity in the summer months when the cows are living entirely upon grass—it would ruin the cheese, it was said, to give artificial food—and expensive winter provender is almost entirely avoided. Thus Mr. Faux's cows run out daily in winter to come home to straw and a little cheap mixture at night. About 70 cwts. of cheese are sold in the year, and recently it has fetched 70*s.* per cwt., though formerly 85*s.*—a less depreciation than that affecting butter.

The country is undoubtedly very much indebted to its breeders of good stock, and it is difficult to see how more could be done in this way than by the interesting example which has been thought worthy of a rather lengthened description. Yet it is to be feared that the exemplar receives a very inadequate reward for his outlay, industry, and enterprise.

Mr. Lynn, of Stroxton, again, is the happy possessor of an extremely valuable and well-descended herd of Bates' shorthorns, and his sideboard overflows with the spoils of the showyard—as well it may, since no less than 3,000*l.* has been won for cattle by his father and himself since 1860, and something over 1,000*l.* for sheep and pigs. The Stroxton herd is of the Red Rose tribe, which are directly descended from the celebrated Cambridge Roses of Mr. Bates. Mr. Lynn's father refused 2,000*l.* for the foundation cow of the Stroxton cattle. Very high prices have been made of young bulls to go to New Zealand, and elsewhere across the water, and for one which the Judges saw in their visits, about 12 months old, 260*l.* had been refused by Mr. Lynn, whilst another of the same age was sold to go to South America for 210*l.* Such a record, although far from exhaustive, is sufficient to indicate the quality and blood of the animals, and it is almost unnecessary to say that the inspection of those which were shown afforded an opportunity of no ordinary interest. The herd at the present time numbers 29 very select specimens indeed, and the Judges do not doubt that Mr. Lynn, who is a young man with his heart evidently in the work, and but recently entered upon the occupation, will turn his promising start to the best advantage, and maintain, if not surpass, the previous reputation of the family. He is also breeding some useful sheep of Lincoln and Hampshire blood, and has a superior stock of Berkshire pigs. The farm looked well; and the crops were of some promise, and, like the animals, of select varieties, and sold for stock. The occupation has been in the family for several generations, and most of the premises, as also, indeed, the greater part of the new parish church, seem to have been erected by the tenants at their sole expense.

Good accounts are kept, and a proper balance-sheet was forthcoming.

The farm of *Mr. Henson, of Prestwold*, is managed throughout all its departments in a manner which any man of business would unhesitatingly commend, without presenting special features of sufficient interest for detailed description. No accounts were forthcoming.

The farms of *Mr. Morley, of Leadenham*, and *Mr. Dyson, of Goldthorpe*, may be spoken of in very similar terms to the above. The former, who is also a land agent, keeps very careful and complete accounts, and had evidently effected considerable improvements upon his occupation, particularly to the permanent grass.[1]

Mr. Martin, of Wainfleet, whose farm was entered for competition, withdrew from the contest shortly after the first visit to him. In this course he was doubtless well advised, having at length appreciated the almost insurmountable obstacle which his very short tenure—of one year only—must of necessity present to his chances of a prize. But for this unfortunate circumstance, the Judges would doubtless have had at least one opportunity of seeing a well-managed farm of the better Lincolnshire soils. Certainly the quality of the stock, their treatment, and all that was seen on the first occasion, awakened much anticipation of future visits.

Conclusion.

It would be very ungracious as well as ungrateful to close this report without a concluding word of thanks to the competitors for their generous hospitality, and great readiness to assist the Judges in so many helpful ways through their by no means easy task. But though farm judging, if at all thorough, may fairly be called hard work, it is at the same time certainly very interesting, and, what is still better, very instructive.

Unless the writer and his colleagues are much mistaken, it has not often fallen to the lot of their predecessors to find so high an average of good management, particularly upon the lighter class of soils, as has been, however imperfectly, recorded above. Clearly the pluck and enterprise of the British farmer are still equal to the measure of his adversities. The very wealth of good examples has in fact prevented the selection of any but the most prominent features for description, and there was much

[1] The Judges had great pleasure in recommending Mr. Morley's farm bailiff, Chas. Chapman, to the attention of the Society as an old servant of twenty-one years, thoroughly reliable and capable in every department of his work.

in the management of some even of the unnoticed farms that was highly creditable, and above the average in merit. May no future reporter have greater cause for regret!

XXVIII.—*Report of the Senior Steward of Implements at Nottingham.* By JOHN HEMSLEY, Shelton, Newark.

THE usual remarks expected from a retiring Steward of Implements will this year be very few: the report of the trials of Hay and Straw Presses and general remarks upon the exhibition of Implements being in such competent hands.

The site for the Nottingham Exhibition was one of the best, if not the very finest, the Society has had. Situated upon a naturally dry soil, with a surface sufficiently level, relieved by picturesque clumps of trees, beautifully fringed on nearly all sides by fine timber trees, and almost under the shadow of two such noble buildings as Nottingham Castle and Wollaton Hall, besides being within a mile and a half of the best parts of the town of "fair" Nottingham, it was almost unique. The Local Committee must feel much gratitude to Lord Middleton for placing at their disposal, in such a generous and open-handed manner, this part of his park. No other eligible site could have been acquired within a reasonable distance of so populous a centre as Nottingham.

The history of Wollaton Hall not being so well known as that of the other grand feature of the vicinity (Nottingham Castle), I thought it might be of interest to give a short history of this noble building, and I am indebted for the following interesting historical note to the facile pen of Lady Middleton—the lady of the manor—who so kindly acceded to my request.

Wollaton Hall was built by Sir Francis, son of Henry Willoughby and Lady Anne Grey (Dorset), who was aunt to Lady Jane Grey, the nine days' Queen. She and her husband died early, and left a young family, who were mainly brought up with the Greys at Tytley. Thomas, the eldest of these young Willoughbys, died as a youth, and his brother Francis, who succeeded, not finding the ancient house of Wollaton commodious, commenced, in 1580, the present one. His architect was John Thorpe, styled of Padua, whose architector or surveyor or clerk of the works was one Smithson, to whom there is a pretty tablet in Wollaton church.

The house was not finished till 1588; therefore this year is its tercentenary. The stone was carried on the backs of mules, &c., from Ancaster [a distance of 30 miles] and coal in payment sent back. Cassandra Willoughby, Duchess of Chandos, daughter of the natural philosopher, Francis Willoughby of Wollaton and Middleton, writes, in 1702, that the accounts for the building, &c., were in the keeping of her brother Sir Thomas (first Lord Middleton), that many artificers came from Italy, and that the cost of the

building, notwithstanding that labour was cheap, and without the value of the stone, was in those days four-score thousand pounds.

Sir Francis Willoughby seems to have lived in some state, for when Queen Elizabeth, who was his second cousin, announced a visit to him at the old house of Wollaton, it was not considered fitting that less than fifty gentlemen should form his retinue; the directions for the marshalling of the hall and buttery, and other household arrangements, also point to wealth, but it appears that the new Hall was not wholly furnished for long, and a portion was burnt not long after it was completed.

Sir Francis's married life was unhappy. He only left daughters, the eldest of whom married Sir Percival Willoughby 'de Kent' of the house of Eresby, the direct ancestors of the present Lord Middleton.

Wollaton has been much altered internally, by Geoffry Wyatt, who has deprived the interior of much of its Elizabethan character; the great hall remains intact, save that the sixth lord stripped it of its panelling, which he testifies was worm-eaten. The second wife of the builder Sir Francis, and the beautiful widow of the fourth lord, each in her day took care that very little of interest or value was left, the former, among other things, carrying off one hundred pieces of silver plate, and the latter removing all but the worst of the furnishing plate, pictures, jewels, &c. Had not her heirs, and her own conscience (by will) returned a little, Wollaton itself would be the only record of past possessions.

Henry, sixth Lord Middleton, altered the outside gardens, &c., and spent large sums, which in these days of agricultural woe make one stare: the Lenton Lodge and the large Camellia House on the terrace having each cost 10,000*l*. He was a great employer of labour and a most popular man, and spent his wealth right royally.

The Willoughbys of Wollaton seem to have been devout; many bequests appear in the family wills of jewels and other gifts to the Church.

It is believed that the papers stored in the muniment room contain much of interest, historical and otherwise, among other things deeds of the time of the kings of Mercia; but it would take much time to search out worthy matter from the bulk of papers and parchments that crowd the shelves.

Besides the loan of the site of the Show ground, innumerable concessions were made by Lord Middleton, and assistance of the most valuable kind was rendered by his very efficient agent, Mr. Wright, and others acting under him. There was also nothing wanting on the part of the Local Committee, who were at all times ably represented by their indefatigable Secretary, Mr. Barron.

The yard was admirably arranged, and for convenience certainly an improvement on all previous ones. The extent of shedding for implements this year was 10,743 feet, compared with 8,217 at Newcastle in 1887, and the number of implement entries 4,717 as against 3,616 at Newcastle. The charge for the shedding for Agricultural articles has been lowered, and is now as nearly as can be ascertained the cost price to the Society.

The following statement, showing the number of feet taken of each description of shedding, and the number of articles exhibited in the Implement Department during the last eight years, may be useful for purposes of reference:—

Description of Shedding	Nottingham 1888	Newcastle 1887	Norwich 1886	Preston 1885	Shrewsbury 1884	York 1883	Reading 1882	Derby 1881
	feet	feet	feet	feet	feet	feet	feet	feet
Ordinary	7,253	5,508	7,155	8,417	9,315	9,569	9,326	9,138
Machinery in motion	1,607	1,125	2,017	2,063	2,035	1,949	2,289	2,102
Special shedding . (Including seeds, models, &c.)	1,883	1,584	1,640	1,520	1,554	1,618	1,402	1,511
Total feet of shedding	10,743	8,217	10,812	12,000	12,904	13,136	13,017	12,751
No. of articles exhibited	4,717	3,616	4,656	5,313	5,241	6,058	6,102	5,960

Some extraordinary mistakes sometimes come under the notice of the Stewards from exhibitors either not reading or not paying attention to the printed regulations sent to them. The Judges appear to have more difficulty year by year in recommending to the Stewards the disposal of the Silver Medals. The Council in offering prizes for Hay and Straw Presses wished to simplify and economise that operation, and so to reduce the cost of railway carriage and other means of transit: the advantage gained under this head is fully shown in Mr. Pidgeon's very able report.

I may point with satisfaction to the increasing attention which appears to be paid to Bee-culture—application having been made for double the amount of space for this department of our show-ground as compared with former years.

Although not coming directly within my province, yet I may be permitted to allude to the great interest manifested during the whole time of the show in the Dairy operations and exhibitions, and to the unwearied and able manner in which these were organised and conducted by Sir John Thorold. I may also be allowed to remark, that although the time of year is not suitable for a show of Poultry, yet in my opinion a national Agricultural exhibition like the "Royal" could not be considered complete without it.

The expeditious and careful manner in which the Midland Railway Company (with their grand display of horses) got the machinery and implements into the yard was highly satisfactory, and I imagine sleeper roads within the yard have become a *sine quâ non*.

The marked harmony of this year's meeting in all its varied departments, and the exceptionally good report the London Police gave of the behaviour of an enormous crowd at Nottingham, are matters of congratulation to all—and especially I allude to this in my native county—not a single case having been reported by the police.

The weather during the week was disappointing, and on Monday and Wednesday a good deal of rain fell. The attendance of the public, notwithstanding, was of the most gratifying kind, and if Nottingham cannot boast of the largest amount of gate-money in the annals of the Society, it has at least achieved the proud pre-eminence of sending the largest number of people into the show-yard on any one day. On Thursday the 12th July the phenomenal number of 88,832 persons paid for admission, and taking into consideration the exhibitors and their assistants, the staff, members of the Society, season ticket holders, and others entitled to free admission, it is hardly an over-estimate to say that there must have been a hundred thousand people on the ground. Those who saw the on-coming crowds from the top of the Lenton Lodge could only liken them to a swarm of ants bearing down upon Wollaton. At the time of greatest pressure all the exits were turned into entrances, and the stewards of finance, the secretary and all his available staff were taking shillings in their hats, in their pockets, or in pouches, in order to relieve the pressure on the turnstiles, which clicked incessantly for hours.

The figures as to the attendance were indeed so interesting that I asked the Secretary to compare them with the records of past years, and I subjoin the memorandum which he has sent me on the subject.

On the Thursday of the Nottingham Meeting the number of persons that paid for admission (88,832) was the largest in the annals of the Society.[1] The nearest approach to these figures was on the Thursday of the Newcastle meeting last year, when the attendance was 77,410. The first shilling day always has had, indeed, a special attraction for visitors, and it may be interesting to record the numbers on each occasion when the attendance has exceeded 50,000 in one day.

1861. Leeds	73,824	1877. Liverpool	51,313
1864. Newcastle	56,902	1879. Kilburn	50,255
1868. Leicester	52,829	(2nd 1*s.* day, Saturday)	
1869. Manchester	57,129	1881. Derby	53,291
1871. Wolverhampton	52,466	1883. York	63,097
1873. Hull	50,312	1887. Newcastle	77,410
1876. Birmingham	58,384	1888. Nottingham	88,832
„ (second 1*s.* day)	61,567		

[1] The number was also the largest one-day's total in the history of exhibitions of recent times, and is believed to have been only exceeded in the year of the Great Exhibition of 1851, when in the last week (October 6–11), 103,516 persons passed the turnstiles on the Monday, 104,630 on the Tuesday, 105,663 on the Wednesday, and 86,887 on the Thursday—the last shilling day. (*First Report Roy. Commrs. of* 1851, Appx. xvi.). There are stated to be only two other occasions besides these of 1851, and the Newcastle and Nottingham Shows of the Society in 1887 and 1888, when more than 75,000 persons paid for admission at any Exhibition on a single day, viz., at the Colonial and Indian Exhibition on the Whit Monday and August Bank Holiday of 1886, when 80,294 and 81,516 admissions respectively were recorded.—E.C.

The total number of persons passing the turnstiles during the Nottingham Show was 147,927, which has only been three times exceeded: at Manchester (1869), when there was an extra shilling day—Saturday—which brought in 36,392 persons, and raised the total to 189,102; at Birmingham (1876), when there were two splendid shilling days on Saturday and Monday, which made the total attendance 163,413: and at Kilburn (1879), when the show was open for ten days and there were 187,323 admissions. Nottingham stands, therefore, fourth on the list. The occasions on which over 100,000 persons have passed the turnstiles during the show are:—

1861. Leeds	145,738	1878. Bristol	122,042
1862. Battersea	124,328	1879. Kilburn	187,323
1864. Newcastle	114,683	1881. Derby	127,996
1869. Manchester	189,102	1883. York	128,117
1871. Wolverhampton	107,519	1886. Norwich	104,909
1873. Hull	104,722	1887. Newcastle	127,372
1876. Birmingham	163,413	1888. Nottingham	147,927
1877. Liverpool	138,354		

The total turnstile receipts on the Nottingham Thursday exceeded 4,418*l.*, a day's total which has only been beaten on one occasion since the Society was established. On Wednesday, July 21, 1869, at Manchester, their Royal Highnesses the Prince and Princess of Wales visited the Society's showyard together, and on that day 39,405 persons paid half-a-crown for admission to the yard, yielding a total sum of 4,953*l.* On no other occasion has so much as 4,000*l.* been received from admissions in one day. The days on which more than 3,000*l.* was received have been as follows:—

Date.	Place.	Price of Admission.	Sum Received. £
22 July, 1858	Chester	2*s.* 6*d.*	3,101
18 July, 1861	Leeds	1*s.*	3,695
20 July, 1869	Manchester	5*s.*	3,243
21 July, 1869	"	2*s.* 6*d.*	4,953
24 July, 1876	Birmingham	1*s.*	3,066
12 July, 1877	Liverpool	2*s.* 6*d.*	3,057
19 July, 1883	York	1*s.*	3,159
14 July, 1887	Newcastle	1*s.*	3,864
12 July, 1888	Nottingham	1*s.*	4,418

The total receipts at the Nottingham Meeting from Admissions, Catalogues, Season Tickets, and the Grand Stand were 10,521*l.* 9*s.* 10*d.* The only occasions on which the total receipts have exceeded 10,000*l.* have been:

	£		£
1861. Leeds	10,570	1879. Kilburn	16,214
1862. Battersea	10,664	1881. Derby	10,731
1869. Manchester	18,114	1883. York	11,706
1876. Birmingham	13,543	1885. Preston	10,309
1877. Liverpool	14,471	1888. Nottingham	10,521
1878. Bristol	11,073		

The accounts for the Nottingham meeting have not yet been finally adjusted, but so far as they have been made up they show a surplus of receipts over expenditure of upwards of 4,000*l.* So large a surplus has only been recorded on four other occasions in the history of the Society, viz. at Leeds in 1861 (4,471*l.*), Manchester in 1869 (9,153*l.*), Derby in 1881 (4,500*l.*), and York in 1883 (5,200*l*). In all but fifteen of the forty-nine country meetings of the Society the receipts have been insufficient to cover the expenditure.

A rather interesting and amusing finish to the meeting took place on Saturday morning. A sum of money was collected by a few gentlemen to be given in prizes for athletic sports, to be competed for by the London and local police in tugs-of-war, running, throwing the ball, &c. In most of these contests the county men were either too much or too strong for their friends, greatly to the gratification of the local spectators. And thus was brought to a close one of the most pleasant meetings the Society has ever held.

I cannot close my report without expressing a certain amount of regret at quitting office; and I sincerely thank my brother Stewards and all other officials connected with the Society for their kindness shown towards myself. This has greatly added to the pleasure I have had in again serving my term as Steward of Implements, the duties of which are rendered as light as they can be, mainly by the able manner in which the business of these great meetings is organised and carried out by the Honorary Director, Mr. Jacob Wilson.

XXIX.—*Report on the Trials of Hay and Straw Presses at Nottingham.* By Dan. Pidgeon, Assoc. Inst. C.E., Reporting Judge.

Judges.

Dan. Pidgeon, Holmwood, Putney Hill, S.W.
W. Scotson, Mossley Hill, Liverpool.
T. H. Thursfield, Barrow, Broseley, Shropshire.

Several causes have recently conspired to bring the question of hay and straw pressing into notice. The agricultural depression has obliged the British farmer to make the best of everything he produces. The conditions under which he farms have become less stringent with dwindling rents; while the foreigner, who is sending large quantities of compressed hay and straw to this country, has, thereby, given him a rude lesson in thrift.

Such are the circumstances under which, braving the possible reproach of "encouraging the foreigner," the Royal Agricultural Society determined to offer prizes for hay- and straw-pressing machinery at the Nottingham meeting, little imagining, perhaps, at the time when this resolution was taken, how large an entry of such implements would result from their action.

It may well be supposed that, in thus breaking new ground, some difficulties would occur in settling the conditions of trial; but, after a good deal of consideration, the Society's Consulting Engineer was able to suggest, and the Council to adopt, a scheme for ascertaining the relative merits of the machines in question,

which worked exceedingly well, and gave results agreeing accurately with those general impressions which Judges must, in any case, receive during the progress of competitive trials.

The practice of hay- and straw-pressing divides naturally into two branches. The shipper, who pays freight upon measurement, makes his bales as dense as he possibly can; while the English farmer, who has no foreign markets, aims only at getting 50 cwt. of hay or straw into a railway truck, and thus securing the lower rates at which compressed hay and straw are carried by the railways of this country. A density of 2 cwt. to the cubic yard, or 8·3 lbs. per cubic foot, is more than enough for this purpose, and only a few points of merit were consequently allotted in this competition to the attainment of densities in excess of the amount in question.

The following table, giving the rates of three important railway companies for pressed and unpressed hay from Peterborough to some of the larger towns in the country, illustrates the character of the advantages which hay- and straw-pressing offers to the farmer:—

TABLE I.—SHOWING RAILWAY RATES FOR PRESSED AND UNPRESSED HAY AND STRAW FROM PETERBOROUGH TO VARIOUS STATIONS. (COMPANY'S RISK.)

Station.	Miles	Straw		Hay	
		Pressed, 50 cwt. to truck	Unpressed, 20 cwt. to truck	Pressed, 50 cwt. to truck	Unpressed, 30 cwt. to truck
Great Northern—		*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Leeds	110	15 0	31 8	15 0	26 8
London.	76	11 8	28 4	11 8	20 0
Liverpool	160	17 6	40 0	17 6	31 8
Manchester . . .	126	15 10	35 0	15 10	30 0
Sheffield	85	12 6	30 0	12 6	25 0
North Western—					
Birmingham . . .	78	11 8	24 2	11 8	21 8
Birkenhead . . .	147	17 6	40 0	17 6	31 8
Burton-on-Trent .	82	11 8	26 8	11 8	22 6
Oxford	94	13 4	30 0	13 4	25 0
Stockport	146	16 8	35 0	16 8	30 0
Wolverhampton. .	124	15 0	32 6	15 0	27 6
Midland—					
Bath	159	20 10	50 0	20 10	36 8
Bradford	115	15 10	33 4	15 10	28 4
Bristol	170	17 6	40 0	17 6	31 8
Derby	70	10 0	24 2	10 0	20 0
Lancaster	198	21 8	45 0	21 8	36 8
Newport, Mon. . .	187	20 0	43 4	20 0	35 0

Note.—These rates were obligingly furnished to the Reporting Judge by Mr. Perkins, of the firm of Barford and Perkins.

No elaboration of these figures is required to show that there is, roughly speaking, a saving of half the cost in carriage, as between compressed and loose hay or straw; while, as will presently appear, the cost of baling, even with the rudest press, is vastly less than the saving in question. Under these circumstances it is not a matter for surprise that the pressing of hay and straw has, somewhat suddenly, assumed the character of an important and profitable industry, or that certain houses employed in this business are working as many as twenty or thirty presses apiece and making good profits.

That "demand creates supply" is a truism, indeed, but there is probably no example of supply following more rapidly upon demand than in the agricultural implement business, where no new want remains long unexploited, thanks, in a great measure, to the influence of the Society's Annual Show, where makers are brought into close touch both with users and with one another. However this may be, the Society's offer of prizes to a class of implements, not indeed new, but newly in use on British farms, produced no less than forty-three entries of hay- and straw-presses, of which number thirty-two machines (see Table II. on page 573) came to trial in one or other of the four following classes:—

Prizes and Conditions of Trial of Hay- and Straw-Presses.

Class 1.—For a hay- and straw-press worked by steam power—		
	First Prize	£30
	Second Prize	20
Class 2.—For a hay- and straw-press worked by horse power—		
	First Prize	20
	Second Prize	10
Class 3.—For a hay- and straw-press worked by hand power—		
	First Prize	20
	Second Prize	10
Class 4.—For a press for old hay worked by hand power		20

Subjoined are the conditions under which the presses were tried:—

1. Notice of the place and date of the trials will be posted to every competitor as soon as they are fixed.

2. Every competitor must himself provide for the delivery of his machines on the trial ground, and for the removal of the same after the trials.

3. Horses will be provided by the Society to work machines during the trials, but competitors who desire it may provide their own horses. These will be charged at a uniform rate against the machines. Except in the case of combined steam engines and presses, the Society will provide a portable engine for driving Class 1. The engine will be charged at a uniform rate against the presses.

[*Continued on p.* 574.

TABLE II.—LIST OF EXHIBITORS IN HAY AND STRAW PRESS COMPETITION.

Class in which entered	Corresponding No. in Implement Catalogue	Exhibitor's name	Exhibitor's address	Price as entered in Catalogue £	s.
1	3800	Foster, William & Co., Limited	Wellington Foundry, Lincoln . . . (Also entered in Class 2).	75	0
1	3762	Howard, J. & F.	Britannia Works, Bedford . . . . (Also entered in Class 2).	40	0
1	3815	Ladd, John H. & Co. . .	116 Queen Victoria Street, E.C. . . . (Also entered in Class 2).	80	0
1	3814	Lincolnshire Hay and Straw Patent Pressing Company	Boston, Lincolnshire . . . . . . (Also entered in Class 2).	70	0
1	2299	Samuelson & Co., Limited	Britannia Works, Banbury	120	0
2	3815	Ladd, John H. & Co. . .	116 Queen Victoria Street, E.C. . . (Also entered in Class 1).	80	0
2	3814	Lincolnshire Hay and Straw Patent Pressing Company	Boston, Lincolnshire . . . . (Also entered in Class 1).	68	0
2	3819	Stephenson, George . . .	Trent Bridge Works, Newark . . .	70	0
2	3820	Ditto	Ditto	65	0
3	558	Allen, Valentine Ingram .	Spalding . . . . (Also entered in Class 4).	30	0
3	557	Bamber, Joseph	Saul Street, Preston . . . . (Also entered in Class 4).	11	0
3	3801	Foster, William & Co., Limited	Wellington Foundry, Lincoln . . .	70	0
3	566	Hartope, J. & Co. . . .	Midlands Depôt, Leicester	20	0
3	523	Hoodless, James Spencer .	Walkeringham, Notts. . . . . (Also entered in Class 4).	24	0
3	3816	Ladd, John H. & Co. . .	116 Queen Victoria Street, E.C. . .	18	0
3	3099	McKenzie, Thomas & Sons	212 Great Brunswick Street, Dublin .	17	0
3	560	Mayos, Thomas T. . . .	Llangunnock, Ross, Herefordshire . (Also entered in Class 4).	13	0
3	524	Ruck, Henry	Castle Hill, Down Ampney, Cricklade	4	4
3	3821	Stephenson, George . . .	Trent Bridge Works, Newark . . .	50	0
3	3806	Warnes, William	Mintlyn, King's Lynn . . . . (Also entered in Class 2).	35	0
4	558	Allen, Valentine Ingram .	Spalding . . . . (Also entered in Class 3).	30	0
4	557	Bamber, John	Saul Street, Preston . . . . (Also entered in Class 3).	11	0
4	2263	Barford and Perkins . .	Peterborough	25	0
4	2264	Ditto	Ditto	29	0
4	562	Bradbury, Joseph . . .	Charles Street, Oxford Street, Manchester	22	0
			With Travelling Wheels and Shafts £3 extra		
4	3802	Foster, William & Co., Limited	Wellington Foundry, Lincoln . . .	20	0
4	523	Hoodless, James Spencer .	Walkeringham, Notts. . . . . . . (Also entered in Class 3).	24	0
4	3817	Ladd, John H. & Co. . .	116 Queen Victoria Street, E.C. . .	12	0
4	560	Mayos, Thomas T. . . .	Llangunnock, Ross . . . . (Also entered in Class 3).	13	0
4	522	Scott, Elton	169A High Street, Lincoln	25	0
4	3822	Stephenson, George . . .	Trent Bridge Works, Newark . . .	25	0
4	3808	Warnes, William	Mintlyn, King's Lynn	35	0

Conditions of Trial (continued).

4. Every machine must be delivered at the depôt on the trial ground, in proper working order, before 9 A.M. on the first morning of the trials.

5. Exhibitors are expected to provide their own drivers and attendants, but the Society reserves the right to provide men and to work any machine if a competitor be absent or not ready, or who says that his men are absent, after due notice has been given to him to bring his machine out for trial.

6. Before starting work, the competitor must declare the number of men and horses required by his machine. If he, personally, or any other extra attendant, not included in such declaration, should render any actual assistance in working or adjusting the machine during the trial, the fact will be noted by the judges.

7. Each machine will be allowed a preliminary trial not exceeding one hour's duration with each material it may be required to compress.

8. The trial will last till not less than 50 cwt. has been pressed by horse or steam power, and till not less than one ton has been pressed by hand power.

9. No trial will be considered as of any use unless the bales have such a form and density that 50 cwt. of pressed material can be loaded into a railway truck having a capacity of 25 cubic yards.

10. The machines in Class 1 will be tried on straw, new hay, and old hay. The straw-pressing machines in Classes 1, 2, and 3 will be tried with straw and new hay, and, should any competitor desire it, with old hay also. The hay presses in Class 4 will be tried with old hay only.

11. The following will be the points awarded:—

	Points.
1. Cost of machine compared with the rate it is capable of working—that is, cost per ton per day of 10 hours .	15
2. Cost of labour and power per ton per day of 10 hours—mechanics rated at 5*s.* per day, labourers at 3*s.* per day—steam engine and driver 2*s.* per nominal horse-power per day—horse-works, horse, and driver 9*s.* per day—Ditto two horses, 16*s.* per day	15
3. Density attained beyond 2 cwt. to the cubic yard . .	5
4. Uniformity in weight	5
5. Time in binding bales	5
6. Cost of bands of bales	10
7. Form of bales with reference to packing into trucks and handling	10
8. Condition of pressed material on opening bales . .	5
9. Transportability of press and facility for erection . .	10
10. Mechanical simplicity, strength, and durability . .	20
	100

The trials commenced on July 3, and were continued, day by day, until the evening of July 9, when no less than forty-seven separate experiments had been concluded. The presses were not tried in the order of their classification, a commencement being made on Class 3, but it will convenience readers of the Journal to describe them in that order, even at the expense of some inversions of dates. For the same reason, the results of the trials will be displayed, class by class, in a tabular form, to which, instead of a too detailed account of each trial, the reader in search of general conclusions is referred.

Trials of Hay and Straw Presses worked by Steam Power.—Class 1.

Four machines competed in this Class, viz:—

Samuelson . . .	No. 2299	Ladd	No. 3815
Howard	„ 3762	Foster	„ 3800

The trials commenced on July 6, and ended on July 9. They were conducted first upon loose straw and loose hay, while the final trials took place on new hay, carted, in rather damp condition, from Lord Middleton's hay-fields. Each exhibitor was allowed a preliminary trial, of which the Judges took no notice, in order that he might see if his press was in working order. All four machines were tried a second time, but Foster's press (No. 3,800) was thrown out before the final trials, which took place upon new hay.

Article No. 2,299 (Fig. 2, p. 602) exhibited by *Samuelson & Co.*, Banbury, Oxon., was first tried in this class.

This machine, better known as the "Pilter" Press, is of American origin, improved by the makers in this country. It produces cylindrical bales of considerable density, permitting 10 lbs. of straw, or 16 lbs. of hay, being packed into a cubic foot of freight measurement. The cylindrical bales are easily rolled from place to place, a great advantage in view of the fact that the practice is to make straw bales weighing $1\frac{1}{2}$ cwt., and hay bales weighing $2\frac{1}{2}$ cwts.

Hay, or straw, is fed by two men, standing one on each side of the machine, into a kind of divided "chaff box," its passage along which is assisted by a pair of packing-forks, entering the "chaff boxes" from below, with a motion similar to that of a sewing-machine feed.

On reaching the mouth of the press, which is two feet in diameter, the hay, or straw, as it issues from each feeding-box, is laid hold of by a conical roller, revolving against a metal disc, which, itself slowly rotating, forms an abutment against which the loose material is compressed by the action of the roller.

This disc, or platten, slides backwards, as the material accumulates, against the resistance of a pair of compressors, which clip, with a determinable amount of friction, the square spindle of the platten.

After the latter has retreated some four feet, the machine stops automatically, and a compressing screw is thrown into gear which forces the platten back over about a third of the path it previously travelled.

The bale is bound, while under this secondary pressure, with two previously prepared wires, having a loop at each end, and caught together by an open chain-link, easily removed, when it is desired to open the bale, by means of a special spanner, both wires and links being available for repeated use.

The "Pilter" Press is, strictly speaking, discontinuous in its action. The time occupied in making a bale is about five minutes, of which three minutes are occupied in baling, and

two in tying. Baling takes place against a resistance which, as will presently appear, involves a loss of energy; while the stoppage of two minutes in every five for the purpose of wiring constitutes a supplementary loss of time. The number of men tending the press was two; the output was relatively small, but the density obtained very great. Straw was crushed a good deal in the process of baling, while the power absorbed was considerable. When the compressing screw was put into gear, the engine was, momentarily, asked for some four times the power required during the rest of the operation. The press worked supported on its own travelling wheels, and is easily transported from place to place.

Article No. 3,762 (Fig. 3, p. 603), exhibited by *J. & F. Howard*, Britannia Works, Bedford, was the next machine tried. This was, strictly speaking, a "continuous" press, for the process of baling, although intermittent, was not stopped for the purpose of wiring.

Hay, or straw, the latter as it comes from the thrashing machine, was fed into a capacious receiver, whence it passed into a compressor, consisting of two endless bands, inclined to each other, and constructed of strong wooden slats, hinged together, and travelling over vertical rollers. These "aprons" are 6 ft. long, 4 ft. apart where the hay or straw enters, and 14 in. apart at the mouth of the press, which is 18 in. deep. A crank and ratchet arrangement gives an intermittent rotating movement to the forward rollers around which the endless bands turn, the latter advancing 4 inches for every movement of the ratchet, or 3 feet per minute, at the speed adopted by the exhibitors.

The bale, issuing from the mouth of the press, is temporarily held together by means of U-shaped steel cramps, or "retainers," which are slipped over it until wire ties can be substituted for them. These, which are usually placed 1 foot apart in straw, and 8 in. apart in hay, are passed by needles through grooves in a table which receives the rectangular "sausage" of hay or straw, and then twisted up by a pair of pliers.

A man, armed with a "Lightning" hay-knife, cuts the "sausage" off to any required length while it is still issuing from the press, being assisted in this operation by a downward inclination given to the path of the truss at the point where he stands, an inclination which encourages the bale to open under the action of the knife, and assists the operator in the same way as does a sawyer's wedge.

One man feeds, and another, standing in the receiver, tramples the material into the mouth of the compressor, while four men are required at the mouth of the press for the purpose of cramping, wiring, and cutting off the bales.

The output of this machine was good, while it could evidently have done much more work if its speed had not been limited by the inability of four men to cramp and tie as fast as the "sausage" issued. In the particulars of trampling, cramping, wiring, and cutting off the truss, the Judges felt that this press was a compromise between manual labour and machinery, and the fact that six men, in all, were required for one or other

of these purposes was fatal to the prospects of the machine as a competitor for either prize.

But, aside from these considerations, the performance of the Howard Press was admirable. It obtained a density, not great, indeed, but more than was required by the conditions of the trials. Its output was large, and might have been larger if the bales could have been wired automatically. It was well suited to receive and to deal with stuff coming from a thrashing machine. The low, but sufficient, density, together with the "end on" feed, ensured the best possible condition of straw in the bale, while the power absorbed was moderate.

Article No. 3,815 (Fig. 1, p. 602), Ladd's Perpetual Press, was exhibited by *J. H. Ladd & Co.*, Queen Victoria Street, London.

Ladd's Press is a continuous machine, no stoppage being made for wiring or removing the bales. It is a modification, under Capel's patents, of the well-known American "Dederick" Press, which has been exhibited at several Royal Shows, and described in past numbers of the Journal.

Let the reader imagine a square pipe, partially filled with plastic material, to which a fresh portion of similar material is added at every stroke of a plunger, moving backwards and forwards in the unoccupied portion of the tube, and he will have a picture of the "Ladd" Press. If he further supposes that the occupied part of the pipe can be cramped at will upon its contents, he will understand how the density of Ladd's bales is determined. In such an apparatus every addition of unpressed material causes the extrusion from the end of the pipe of a similar quantity of compressed stuff, whose density depends upon the amount of friction induced by cramping between the pipe and its unextruded contents.

In the press under review, the material to be baled is fed by a man, handling a fork, piecemeal into the body of the press. There, a platten, which has a to-and-fro motion communicated to it by a suitably geared crank and connecting rod, drives each mouthful of hay or straw introduced by the feeder back upon other already compressed material occupying the rear of the box. Six lateral latches, three on either side of the press-body, serve to retain each newly pressed mouthful of hay, and when enough for a bale has been compressed, the feeder introduces a square board, called a "follower," loosely fitting the box, and provided with three cross grooves for the later admission of the binding wires. Binding is accomplished as each bale passes rearward, and after it has reached a portion of the press-body from which the sides have been removed for this purpose. After wiring, the bales, together with their "followers," are successively extruded from the press, the former being removed, while the latter are returned to the feeder for repeated use.

The output of Ladd's Press was greater than that of any other machine tried in Class 1, while the density obtained was

considerable, approaching nearly to that of the Pilter Press. The condition of the compressed material was not so good as in the case of the Howard machine, but better than that of the "Pilter" Press. The power absorbed was considerable, but uniform in amount, and the cost of baling per ton was less than that of any other competitor in the Class. Three men were employed in tending the press, but neither of them was overworked.

In passing rapidly, as was unavoidable in these trials, from the pressing of one material to another, it was not easy to adjust the density of Ladd's bales in a moment; but it was evident that, in ordinary work, the compression screws being once set, they would need scarcely any attention all day long.

This press is well adapted to take stuff as it issues from a thrashing machine. Its output is large, density high, and the cost of baling relatively moderate. The machine works supported on its own travelling wheels, and is easily removed from place to place.

Mention has been made of the large absorption of power exhibited by both the "Ladd" and "Pilter" Presses, and an explanation may be conveniently given here. In both machines, but in Pilter's case continuously, while in Ladd's case discontinuously, the bales are extruded, after compression, against considerable friction. This friction, in the "Pilter" Press, consists of the resistance to the issue of the bale offered by the compressors, which grip the square shaft of the platten, while in the "Ladd" Press the issuing hay is itself gripped by the press-body. In the latter case, after a mouthful of hay has been compressed to a determined density, the abutment against which such compression was effected is itself moved backwards for an inch or two against a frictional resistance equal to that which it afforded to material in course of pressing, and so on for every stroke of the piston. Exactly the same thing occurs in the "Pilter" Press, although the action in this case is continuous and not intermittent. Howard's Press is free from this defect, and hence its more moderate use of power.

Article No. 3,800 (Fig. 4, p. 604) was exhibited by *Messrs. W. Foster & Co., Limited*, Wellington Foundry, Lincoln. This press, constructed under the patents of Messrs. Watson & Starkey, is double-acting, one truss being compressed while the material for a second truss is being fed into the box and trampled.

The machine consists of a long box, forming the press-body, carried horizontally upon travelling wheels. In the box there moves back and forth a piston, or platten, having two ears or lugs projecting through slats on either side of the box. Each lug carries a nut threaded upon a hori-

zontal screw running the entire length of the machine. Both screws are driven, by belting, through suitable pulleys and gearing, the former furnished with an ordinary reversing motion, like that of a planing machine. The press-body has a central opening for the reception of the stuff to be pressed, while each end of the box is closed by a strong wooden door having four slots in it for the passage of the wire by which the bales are ultimately bound. Assuming that a bale has just been expelled, and the press-body full of loose hay, then, by throwing the belt on to the proper pulley, the platten moves away from the bale already pressed towards the other end of the box. When bale number two has been sufficiently squeezed, the belt is shifted, automatically, on to the reversing pulley, and, in the meantime, the press-body has been again filled with loose material. The finished bales are partially extruded from the press-body by continuing the action of the piston after the end door is opened, and this extrusion absorbed a surprising amount of power. The bearing of this fact on the loss of energy in "continuous" presses of the Ladd and Pilter type is evident.

Four men were engaged about the Foster Press. The output, whether in hay or straw, was moderate, while the density obtained in straw was only 7 lbs. per cubic foot, or less than the Society's requirements, and only $9\frac{3}{4}$ lbs. in hay.

The condition of the bales was good, standing, in this respect, about midway between Howard and Ladd. The power absorbed was considerable, especially towards the end of the platten stroke, when the loud beating of the exhaust, coming, it must be remembered, from an 8-horse engine, told, as plainly as the indicator diagrams themselves, of the severity of the work.

Want of uniformity in the power absorbed must prove a great drawback to any hay-press. The size of engine required is determined, not by the minimum, but by the maximum demand for power, and the Foster Press needs a large engine to drive it, while making very irregular use of its energy. The cost of baling, due to an excessive power and labour bill, coupled with a moderate output, was considerable, and, in view of these considerations, this machine was excused from taking part in the final trials.

The First Prize in Class 1 fell to Ladd, and the Second Prize to Samuelson, but it was a matter of regret to the Judges that the principle of Howard's Press did not receive a fairer show at the hands of its makers. But for its excessive labour bill, this machine would have run both the Prize Presses hard.

The trials in Class 1 were rendered specially interesting by the fact that all the competing presses differed entirely one from the other in their mode of working. A further striking fact was that they all, except Howard's, absorbed a great deal of power in proportion to the work done, while the cost of baling per ton was, generally speaking, greater than in the best hand presses, although, it must be added, the densities obtained were also much greater. This variety in constructive principles,

together with the waste of energy already alluded to, indicate that the steam-power straw- and hay-press of the future is still to seek. Perhaps, when Ladd and Pilter have stopped their open leaks of power, and Howard has substituted machinery for men, some future trials of the Royal Agricultural Society may introduce farmers to an economical as well as efficient press of this kind. The efficiency is already on hand, but the economy might be greatly improved.

TABLE III.—SHOWING RESULTS OF TRIALS IN CLASS 1.

Date of Trial	Order of Trial	Name of Exhibitor	Catalogue number	Price of machine	Duration of trial	Total weight baled	Quantity baled per day	Mean density of bales	Indicated H.P. absorbed	Nominal H.P. required	Cost of H.P. at 2s. per H.P. per day	Cost of labour employed at 3s. per man per day	Total cost of power and labour per day	Cost of baling per ton
First Trials, in Loose Straw, at Fodder Yard.														
				£	min.	lbs.	tons.	lbs. per c. foot	I.H.P.		s. d.	s. d.	s. d.	s. d.
July 6	38	Samuelson	2299	128	45	1196	7·10	13·40	5	4	8 0	6 0	14 0	1 11½
July 7	40	Howard .	3762	40	15	656	11·70	8·90	3·5	3	6 0	18 0	24 0	2 0½
"	42	Ladd .	3815	80	15	788	14·00	10·77	5	4	8 0	9 0	17 0	1 2½
"	44	Foster	3800	75	23	905	10·50	6·90	7	6	12 0	12 0	24 0	2 3½
Second Trials, in Loose Hay, at Fodder Yard.														
July 7	39	Samuelson	2299	128	37	1583	11·45	19·70	5	4	8 0	6 0	14 0	1 2½
"	41	Howard .	3762	40	16	944	15·80	13·55	3·5	3	6 0	18 0	24 0	1 6
"	43	Ladd . .	3815	80	11	1185	28·80	15·40	5	4	8 0	9 0	17 0	0 7
"	45½	Foster . .	3800	75	21	1403	17·90	9·93	7	6	12 0	12 0	24 0	1 4
Final Trials in Loose New Hay.														
July 9	45	Samuelson [1]	2299	128	25	1690	18·10	26·40	5	4	8 0	6 0	14 0	0 9
"	46	Howard .	3762	40	10	921	24·60	13·20	3·5	3	6 0	18 0	24 0	0 11½
"	47	Ladd [2] . .	3815	80	11	1373	33·40	23·40	5	4	8 0	9 0	17 0	0 6

[1] Second Prize. [2] First Prize.

TRIALS OF HAY AND STRAW PRESSES WORKED BY HORSE-POWER.—CLASS 2.

Four machines came to trial in this class, viz.:

Stephenson . . . No. 3820
The Lincolnshire Hay and Straw Pressing Co. " 3814
Ladd . . . . No. 3815
Stephenson . . . " 3819

The trials commenced on July 6, in loose straw and hay, and were completed on the same day. Each exhibitor was allowed a preliminary trial (of which the Judges took no notes), in order that he might see if his press was in good working

order. After the first trials were completed, Ladd's, and Stephenson's No. 3,819, were tried a second time upon loose hay, when enough had been done to permit of a decision being made without further experiments.

Article No. 3,820 (Fig. 5, p. 605), exhibited by *Mr. George Stephenson*, Newark-on-Trent, was the first machine to come to trial in Class 2 on July 6. This, and the succeeding machines, were tried upon loose hay and straw, but not upon new hay, as in the case of the steam-power machines. Stephenson showed two presses in this class, characterised, one, by the employment of an ordinary "toggle-joint," and the other by a modification of this well-known device, which may be described as a "half toggle" (see diagram on p. 605). In it, the lower limbs of the ordinary toggle-joint are discarded, while the lower extremity of each upper limb is furnished with a roller, which travels back and forth upon a rail, forming part of the sole-plate of the machine, as the limbs are drawn together or separated. The press under review (No. 3,820) was a "toggle-joint" machine; the "half-toggle" press was tried later.

The machine consists of a vertical box, or press-body, closed at the top by a sliding door, and, laterally, by a swinging door. A platform, placed at such a height that stuff can easily be received from the thrasher and forked through the latter door, surrounds the press-body, and receives loose material. Two men were employed upon this platform, either forking or trampling, and one man drove the horse.

Within the box there is a moving platten which, during the charging operation, forms the bottom of the press-body. The platten is supported by the two upper limbs of the toggle, and is low down in the box when all four members of the joint are widely open, high up in the box when these are closed.

The toggle is operated by a chain, which, after passing around a guide pulley to give it direction, is wound upon a windlass actuated by the horse. The platten rises, quickly at first, and slowly at last, through a considerable space—a movement well suited, as it appears, to the pressing of hay and straw, where a gradually increasing pressure, ending in a powerful final pinch, is the thing desired.

When the toggle is open, and while there is little or no pressing to do, the horse's energy is used in bringing the widely separated limbs of the joint together, the leverage being at that moment greatly against him; but when the final pinch is given, and the work of compression is hardest, there is a hardly appreciable leverage against the horse, quâ the toggle, so that his work is equalised throughout the whole movement of the platten.

After a bale has been completed, the windlass is released by means of a clutch, and the platten falls by its own weight, the rapidity of its descent being checked by a brake on the chain-barrel, under the control of the attendant. The bales are tied in the usual way, either with cord or wire, and afterwards tumbled from the platform to the ground.

The ratio of movement between the horse and the platten at the point of maximum pressure is 151 to 1, so that, estimating the pull of the horse at $1\frac{1}{2}$ cwt., this would give 11·3 tons pressure upon the platten,

This machine was tried upon straw, in which material the density obtained was only 6 lbs. per cubic foot. It was manifestly a new and untried apparatus, which, for good reasons of their own doubtless, the makers did not wish to test too severely. However, as will appear when Stephenson's other presses come to be described, the principles upon which it is constructed are good. The output of the machine was the largest obtained in this class, but, as already stated, the density was low.

The power absorbed was very moderate, or equal to that of one horse, pulling about $1\frac{1}{2}$ cwt. for one minute out of every five, and standing during the other four minutes. The cost of baling per ton was the lowest recorded in this class, but the machine was passed over by the Judges because of its obvious imperfections—imperfections, however, consisting merely in matters of detail.

Article No. 3814, exhibited by the *Lincolnshire Hay and Straw Pressing Company, Limited*, of Boston, Lincolnshire, was next started in straw. It made one bale, having a density of 4 lbs. to the cubic foot, but, though it continued working for some time afterwards, was not further noted by the Judges. The press was a crude construction, having so many working parts, operating so irregularly, and with so much friction that any description of it here is unnecessary.

Article No. 3815 (Fig. 1, p. 602), exhibited by *John H. Ladd & Co.*, 116 Queen Victoria Street, London, E.C., was the same article as that already described in Class 1, but rigged for horse-power instead of steam. The exhibitors elected to run the press with a single horse, choosing a very powerful animal for this purpose; but the trial had not progressed far when it became evident that two horses should, properly, have been employed. It is true that the single animal got through the first trial in straw, lasting seventeen minutes, but pulling much harder than was good for him. In the hay trial, which followed, the same horse, after working seven minutes and making three bales, stopped and was changed for another. The second horse was an even finer animal than the first, but five bales, accomplished in sixteen minutes, brought him also nearly to a standstill. Hence, in computing the cost of horse-power per ton, Ladd's Press has been debited with two horses (see points of merit) instead of one, as in the case of Stephenson's machine.

The ratio between the movement of the horse and that of the platten was ascertained to be 1·48 to 1, which, assuming the pull of the horse to have been $2\frac{1}{2}$ cwts., equals a pressure of $18\frac{1}{2}$ tons upon the platten. The press employed three men, also a horse-driver, while its output was a trifle less than that of

Stephenson's No. 3820. The density was considerable, the power, as already noted, also considerable, and the cost of baling per ton large in accordance. The press did its work well in every respect, and, employing two horses instead of one, would give satisfactory results.

Article No. 3819, exhibited by *Geo. Stephenson*, of Trentbridge Works, Newark, was of the "half-toggle" type, having no lower toggle limbs. In all other respects it is exactly similar to No. 3820 (see page 605), consisting of a vertical box, filled from a platform through a lateral door, and a platten which rises and falls as the limbs of the toggle are brought together or separated.

The closing of the toggle-joint is accomplished by means of a chain made fast to one of the arms near the roller, reeved round a snatch block on the other arm, and then led back, parallel to the rail upon which the toggle rollers travel, to a horse-windlass, exactly similar to that which has already been described in connection with machine No. 3820. Considerable height is saved in the "half-toggle" press by the suppression of the lower limbs of the toggle, but at the expense of its length, a change which is, however, taken advantage of to get a better arrangement of travelling wheels. Still it must be confessed that both of this maker's horse-presses are somewhat heavy and cumbersome machines.

The press under review was tried first in straw, and afterwards in loose hay, and did exceedingly good work in both. One horse, walking one minute and standing four out of every five, drove the press with ease, and could have kept on all day long

TABLE IV.—SHOWING GENERAL RESULTS OF TRIALS IN CLASS 2.

Date of Trial	Order of Trial	Name of Exhibitor	Catalogue number	Price of machine	Duration of trial	Total weight baled	Tons baled per day	Mean density of bales	Labour per day at 3s. per man	H.P. per day (see table of points, 2)	Total labour and H.P. per day	Cost per ton
		First Trials, in Loose Straw, at Fodder Yard.										
			No.	£	min.	lbs.	tons.	lbs. per c. foot	s. d.	s. d.	s. d.	s. d.
uly 6	31	Stephenson . .	3820	65[1]	18	575	8·50	6·20	6 0	9 0	15 0	1 9
"	32	Lincolnshire Co.	3814	65			Machine failed.	No notes taken.				
"	33	Ladd	3815	80[2]	17	512	8·00	10·40	9 0	16 0	25 0	3 1½
"	34	Stephenson . .	3819	70[1]	21	666	8·50	8·60	6 0	9 0	15 0	1 9
		Second Trials, in Loose Hay, at Fodder Yard.										
ıly 6	35	Ladd[3] . . .	3815	80	16	627	10·50	13·37	9 0	16 0	25 0	2 4½
"	36	Stephenson[4] .	3819	70	27	1368	13·50	14·10	6 0	9 0	15 0	1 1

[1] Price includes horse-gear. [2] Price without horse-gear. [3] Second prize. [4] First prize.

at the work. It was estimated that his pull was at no time more than 2 cwt.

The ratio of movement between the horse and the platten at the moment of maximum pressure was 301 to 1, equal at 2 cwt. pull of the horse to a pressure of 30 tons on the platten. Two men tended the press, and a third drove the horse. The output was large, a bale, weighing $2\frac{1}{2}$ cwts., being turned out every five minutes, while the density obtained was over the requirement in straw, and considerably over it in hay. The condition of the baled material was good, the bales box-like in shape and well-made, the power absorbed very moderate, and the cost of baling per ton light in accordance.

The First Prize in Class 2 fell to Stephenson's Press No. 3819, and the Second Prize to Ladd's Press, No. 3815.

Trials of Hay and Straw Presses worked by Hand Power. Class 3.

These trials, with which the competition was opened at Nottingham on July 3, brought forward nine competitors, as follows:—

Allen	No. 558	Hoodless . . .	No. 523
Ruck	„ 524	Warnes	„ 3806
McKenzie . . .	„ 3099	Hartope	„ 566
Bamber	„ 557	Mayos	„ 560
Stephenson . . .	„ 3821		

Of these, four machines, viz. Allen, Bamber, Hoodless, and Mayos, were also entered as presses for old hay, worked by hand-power, in Class 4.

The trial commenced on July 3, when all nine machines were set to work successively upon hay and straw, each having been first allowed to make a bale as a preliminary trial (of which the Judges took no notice), in order that the exhibitor might see his press was in good working order.

After the first trials upon straw and hay, five machines, viz. Bamber, McKenzie, Stephenson, Hoodless, and Warnes, went through a second trial, conducted upon loose straw and hay, which also took place upon July 3; and three machines, viz. Warnes, Bamber, and Hoodless, were selected, after the second trial, for a final trial in hay, cut from the stack.

It is to be regretted that none of the machines tried in this class can be considered as thoroughly satisfactory straw presses, whatever they may do in hay. Only one of the machines selected for a final trial was provided with a compression-box, and this

machine was finally thrown out on other grounds. A compression-box appears to be indispensable (except in the case of the so-called continuous machines) to the proper baling of straw. When no such box is used, the bales must be trimmed by the knife in order to ensure such uniformity in size as will permit of their being advantageously stowed in the railway truck, while cutting the straw itself makes waste, and takes value from the baled stuff. The case is similar, but not so important, in baling hay. Here, the loss by trimming is of less consequence, while, as a matter of fact, almost all the hay pressed in this country is cut direct from the stack, and better manipulated without a box than with one.

A further point must be noted in connection with these trials. In laying down condition No. 9, which specifies that 50 cwt. of pressed material must be loaded into a railway truck of 25 cubic yards capacity, the Society inadvertently demanded a needless amount of compression, unobtainable by hand, except at the cost of more time than could be afforded for its economical production. As a matter of fact, the moderate densities which were obtained by the best hand-presses proved sufficient to permit of 50 cwt. of straw bales being loaded into a railway truck. The railway companies allow hay and straw to project 6 inches on all sides of the truck, while they also top up the bales in a roof-like form. Actual inquiry of the Midland Railway Company's officials at Nottingham disclosed the fact that one of their trucks measures, for the purpose of hay and straw transport, 32 instead of 25 cubic yards.

Under these circumstances, and bearing in mind that the Society's object would be thereby fully obtained, prizes were awarded in this class to machines which obtained a density less than that actually specified, but not until after it had been ascertained, in the case of the First Prize machine, that straw boltings such as are delivered by the trusser of a thrashing-machine could be compressed by it to the specified density of 8·3 lbs. per cubic foot. This, however, was a mere experiment, conducted independently of the trials, and having no influence upon the awards.

Mayos' machine (No. 560) fulfilled the specified condition as to density, but it took nearly half an hour to make a single bale, whether of hay or straw—an expenditure of time which is, of course, out of the question. It may here be remarked that Mayos' machine did not receive a second trial on account of an informality in entry, and it is not known, therefore, what this machine could accomplish when aiming at lower densities.

Trials of Class 3 in Hay and Straw.

Article No. 558, exhibited by *Valentine J. Allen*, Spalding, Lincolnshire, was the first implement to come to trial in Class 3 on July 3. After making one bale, this machine became disabled by the slipping of a pinion over two teeth of the rack in which it engaged, whereby the second motion shaft of the machine became bent and the press itself put out of the competition.

Article No. 524, exhibited by *Henry Ruck*, of Castle Hill, Down Ampney, Wiltshire, was a homely tool rather than machine, consisting of a very simple apparatus wherein manual labour is applied directly to the compression of the bale. Hay or straw is laid horizontally between four wooden uprights, opposed to each other, and firmly fastened to a wooden base plate. Along the latter lie two chains, either of whose outer extremities are connected by a cross-piece of wood. When the retainer is full, the chains are thrown around its contents, like strings around a parcel, their wooden terminations forming treadles, upon each of which one of the two attendants stands. These men are furnished each with a wooden maul, wielding which with their right, while clasping each other's left hands, they stamp upon the crossing of the chains, their own weight, meanwhile, serving to take up and retain all the slack chain which they can thus succeed in producing. When the compression is complete, the bale is tied with two cords, and makes way for another supply of loose material.

Ruck's Press, which can hardly be called a machine, succeeded in throwing out a bale every five minutes, but it produced an almost inappreciable compression, whether in straw or hay, only 1·7 lb. of the former and 5·5 lbs. of the latter material being pressed into a cubic foot. Two men were employed about the press; the bales were rough and shapeless, the power absorbed, in relation to the work done, considerable, and the cost of baling, in relation to output and density, high. The machine was not ordered for second trial.

Article No. 3099, exhibited by *Thomas Mackenzie & Sons*, of 212 Great Brunswick Street, Dublin, is of American origin, and consists of a vertical box having two lateral doors at the bottom of the press-body.

The body is filled from the top with loose materials. These, after being trampled, are covered with a platten, and this again with a cross beam, whose extremities project through slots in the ends of the box. Two long wooden levers act, one on each end of this beam, shifting fulcra being provided for them by the teeth of a pair of racks which line the sides of either slot. The platten thus descends step by step, what is gained at each stroke of the lever being secured by palls attached to the cross-beam, and falling

into the same rack-teeth which furnish the fulcra. When no more pressure can be given, the truss is tied with cord in the usual way and discharged from the lateral door at the bottom of the press.

The leverage in the McKenzie Press was 16½ to 1, which, taking the weight of the two men employed at 280 lbs., gives a pressure of 2 tons on the platten. Two men, one at each lever, worked the press. It was unfortunate that the men employed in the trial were quite unskilled in the use of this machine. Had it been otherwise, there is no question but that the implement, which is extremely simple in construction, would have made a much better show. As it was, from fifteen to eighteen minutes were occupied in making each bale, whereas a couple of skilled men would, probably, not have taken half the time. The density obtained did not exceed 4½ lbs. per cubic foot in straw, and 8½ lbs. per cubic foot in hay, while the cost of baling was correspondingly high. Under these circumstances the press was excused from final competition.

Article No. 557 (Fig. 6, p. 606), exhibited by *Joseph Bamber*, of Saul Street, Preston, Lancashire. This press was, without question, the simplest machine on the ground. In appearance it was just like an ordinary cheese-press, provided with a pulley and endless cord for obtaining a quick return of the screw. Two men operated the machine, compressing the materials by means of capstan levers, which rotated the screw. After compression, the platten was returned quickly by means of the pulley and cord, and this simple arrangement worked extremely well. There being no compression-box, the exhibitor was obliged to trim his straw bales with the knife, a practice which has already been discussed and condemned.

The ratio of movement between the capstan lever and the platten was 120 to 1, which, assuming each man to exercise a force of 100 lbs. on the levers, equals a pressure of 10·7 tons on the platten.

The output of this press was good, and the density obtained in both hay and straw relatively good also. The materials were left in good condition in the bales, while the power required was moderate, the two men employed being evidently capable of continuing the work all day without undue fatigue. The cost of baling was low in accordance. This press, which weighs less than 3 cwt., can be easily transported by a hand-cart, which adds 4*l*. to its cost, but if two or more of the Bamber Presses were worked on a farm, one hand-cart would serve for them all, adding little to the first cost of the presses. The extreme simplicity, cheapness, and portability of this machine strongly recommended it to the consideration of the Judges, and to the

agricultural experts especially, while, its work being expeditiously and economically performed, it was ordered for further trial.

Article No. 3,821, exhibited by *George Stephenson*, of Newark-on-Trent, Notts, was exactly similar to the same exhibitor's horse-machine, No. 3,820 (see page 605), but worked with a winch-handle instead of a horse-gear. There is no need, therefore, to re-describe the machine, the more so as it, unfortunately, failed in its first trial.

The chain which is employed, as in the horse-power press, to draw the limbs of the toggle-joint together, was wrapped round a very small barrel, and took on to this at so bad an angle that it was no matter of surprise when, after a few surges, the chain in question broke. The accident was, however, claimed to be due to a defective link, and permission to "repair damages" was accordingly given. But, on the following day, the chain broke again before two straw bales had been made, and the machine was adjudged *hors concours.* This failure was unfortunate, because, in many respects, the press promised well, and was all the more regretted by the Judges since it deprived them of making a comparison between the "toggle" and the "half-toggle" principle.

Article No. 523, exhibited by *James S. Hoodless*, of Walkeringham, Gainsborough, was a vertical press, having a platten, forced downwards, by the action of a screw and gearing, into a compression-box with a lateral door for the extrusion of the bale.

The press is filled from the top, the platten sliding out of the way for the admission of the loose material. After this has been trampled, the platten is replaced, and acted upon, in the first instance, by means of a winch-handle without multiplication of the screw's effect. When no more compression can be obtained by the direct action of the screw, the men who tend the machine shift over to capstan levers on the side of the machine opposite the winch, and impart the final pressure through gearing, which considerably reduces the speed of the platten. The latter is raised, after compression has been effected, by means of the winch. The bales are tied by cords in the usual way, and turned out, at the ground level, through the lateral door.

The press worked slowly, turning out its first (straw) bale, weighing 120 lbs., in 17 minutes, and its second (hay) bale, weighing 207 lbs., in 15 minutes. This want of speed was due, in some measure, to the difficulty experienced in trampling. The cross-head through which the compressing screw passes is close down upon the press-body, and is not removable, and the trampler, consequently, worked with his body inclined instead of upright. The output was small, but the density high, and the cost of baling considerable. Two men tended the press, but, whether

trampling or pressing, they were hard-worked. The Hoodless Press has no special means of transport, but requires to be loaded up into a cart in order to move from place to place. This machine, in the general dearth of meritorious competitors in this class, was ordered for a second trial. The ratio of movement between the capstan levers and platten was 372 to 1, equal, at 100 lbs. pull per man, to a pressure of about 32 tons in the platten.

Article No. 3086 (Fig. 7, p. 606), exhibited by *William Warnes*, of King's Lynn, Norfolk, was a heavy and powerful press, acting vertically on the materials, which are squeezed between a descending platten, forced downwards by a screw and gearing, and a table standing about a foot above the ground-level.

The press is open on three sides, its jaw-shaped frame, which is made of steel angles and plating, being strong enough to take the thrust of the screw. When loose hay or straw is operated upon, it is confined laterally by two swinging doors, while, on the third side, the stuff is kept in place by the plated framework of the machine, together forming the equivalent of a compression-box. The nut in which the screw works is rotated by means of a winch operating upon bevil gears. Of these, there are two pairs, one giving a fast, and the other a slow movement. A clutch between the two pinions serves to put either of them into gear, or to stop the press. The table of the press forms the platform of a weighing machine, counterbalanced by a steelyard and sliding weight, so that the bales can be accurately sized. The winch is turned from a platform attached, at a suitable height, to the framework of the machine, and approached by a short wooden ladder.

The ratio of movement between the winch-handle and the platten is 883 to 1 in the slow motion, equal, with two men on the winch, at 50 lbs. each man, to 39 tons pressure on the platten.

The output of the Warnes Press was not large, but the density obtained was the highest recorded in Class 3. The men, however, were hard-worked, and the cost of baling was considerable. The bales were tied with cord in the usual way. The condition of the stuff in the bales was good, but the want of a proper compression-box for straw obliged this exhibitor also to trim his straw bales with the knife. The press was supported on its own travelling wheels when at work, and could be immediately moved by putting a horse in the shafts, which were not removed. The size of this press was comparatively enormous, and its weight more than twelve times that of Bamber's, but, thanks again to a dearth of worthy competitors in the class, it did the best work of any machine except Bamber's, and was consequently ordered for a second trial.

Article No. 566, exhibited by *J. Hartope & Co.*, Midlands Depôt, Leicester, made only a single truss of straw, and, proving a failure, was withdrawn by its exhibitors.

Article No. 560, exhibited by *T. T. Mayos*, of Llangunnock,

Ross, was next brought to trial in straw. This press is a modification of the American press exhibited by McKenzie, so far as its method of pressing is concerned. But Mayos uses three plattens instead of one, and forces these down upon the loose materials, successively, by levers which operate in exactly the same way as those of the McKenzie Press. He thus obtains a greater density, but with a corresponding expenditure of time. In addition, Mayos' Press is made up of such a number of pieces that almost as much time was spent in taking it apart and putting it together, ready to make a bale, as in making the bale itself. The receiver, in which loose material is placed for the purpose of baling, is similar to the "Bolting Tier" exhibited by Mr. Mayos at Newcastle, and described in the last number of the Journal (p. 201). Like that, it is furnished with a number of strings previously prepared, and so placed that the two ends of any given string can be brought together and buttoned around the truss after it has been compressed.

As previously stated, Mr. Mayos' machine did not get beyond a preliminary trial by reason of an informality in his entry. In that trial, it succeeded in compressing straw to a density of 8 lbs. per cubic foot, but took nearly half an hour to make a bale. There was no opportunity, for the reason just stated, of ascertaining the rate at which this press would make less dense bales, but it would have been very slow without doubt.

On July 3 and 4 the machines of Bamber, McKenzie, Hoodless, and Warnes, which had been selected for a second trial, were again tried upon loose straw and hay. All these machines have already been described, and their performances in a second trial did not differ notably from the first, but McKenzie's continued want of density threw this machine out, and only three machines, viz., those of Bamber, Warnes, and Hoodless, took part in the final trials.

These were conducted on July 4 upon old hay cut out of the stack. Warnes, who went in first, pressed the cut bales, at the rate of $5\frac{1}{2}$ tons per day, with a density of $9\frac{1}{2}$ lbs. per cubic foot; Bamber, who came next, baled, at the rate of $8\frac{1}{3}$ tons per day, with a density of 9·1 lbs. per cubic foot; and Hoodless, who came last, baled, at the rate of 4·2 tons per day, with a density of 9·7 lbs. per cubic foot—Warnes and Bamber making trusses of exactly the same size, and as nearly as possible of 1 cwt. each, while Hoodless's bales were considerably larger, averaging 132 lbs. each. Finally, Hoodless was ruled out, leaving Bamber and Warnes masters of the situation.

As between these two machines there was no question which should be placed first. Bamber had beaten Warnes in

TABLE V.—SHOWING RESULTS OF TRIALS IN CLASS 3.

Date of Trial	Order of Trial	Name of Exhibitor	Catalogue number	Price of machine		Duration of trial	Weight of bales made	Tons baled per day	Mean density of bales	Cost of labour per day at 3s. per man		Cost of baling per ton	
		First Trials, in Loose Straw, at Fodder Yard.											
				£	s.	min.	lbs.	tons	lbs. per c. foot	s.	d.	s.	d.
July 3	1	Allen . . .	558	30	0	Machine broke in making 1st bale.							
,,	2	Ruck . . .	524	4	4	4	32	2·10	3·00	6	0	2	10
,,	3	McKenzie .	3099	17	0	18	80	1·20	4·30	6	0	5	0
,,	4	Bamber . .	557	15	0[1]	9	143	4·20	4·20	6	0	1	5
,,	5	Stephenson .	8821	50	0	3	48	4·30	4·00	9	0	2	1
,,	6	Hoodless . .	523	24	0	17	120	1·80	6·50	6	0	3	4
,,	7	Warnes . .	3806	35	0	9	88	2·60	5·20	9	0	3	5
,,	8	Hartope . .	566	20	0	Failed, and was withdrawn.							
,,	9	Mayos . .	560	18	0	25	112	1·20	8·30	6	0	5	0
		Second Trials, in Loose Straw, at Fodder Yard.											
July 3	10	Bamber . .	557	15	0[1]	25	302	3·20	4·00	6	0	1	10½
July 4	11	McKenzie .	3099	17	0	19	222	3·10	4·10	6	0	1	11½
,,	12	Stephenson .	3821	50	0	Machine failed by breaking chain.							
,,	13	Hoodless . .	523	24	0	22	223	2·70	5·50	6	0	2	2½
,,	14	Warnes . .	3806	35	0	15	181	3·20	5·10	9	0	2	9½
		First Trials, in Loose Hay, at Fodder Yard.											
July 3	1	Allen . . .	558	30	0	Machine failed in straw.							
,,	2	Ruck[2] . . .	524	4	4	5	40	2·10	5·50	6	0	2	10
,,	3	McKenzie .	3099	17	0	15	172	3·00	8·40	6	0	2	0
,,	4	Bamber . .	557	15	0	7	103	3·94	8·24	6	0	1	6¼
,,	5	Stephenson[2] .	3821	50	0	5	72	3·85	6·70	9	0	2	4
,,	6	Hoodless . .	523	24	0	16	207	3·46	8·20	6	0	1	8½
,,	7	Warnes . .	3806	35	0	9	129	3·84	9·00	9	0	2	4
,,	8	Hartope . .	566	20	0	Machine failed in straw, and withdrawn.							
,,	9	Mayos . . .	560	18	0	20	172	2·30	11·86	6	0	2	7
		Second Trials, in Loose Hay, at Fodder Yard.											
July 3	10	Bamber . .	557	15	0[1]	16	238	4·00	9·75	6	0	1	6
July 4	11	McKenzie .	3099	17	0	18	356	5·29	6·90	6	0	1	1½
,,	12	Stephenson .	3821	50	0	Machine failed in straw.							
,,	13	Hoodless . .	523	24	0	27	387	3·80	9·67	6	0	1	7
,,	14	Warnes . .	3806	35	0	17	291	4·54	8·45	9	0	1	11¾
		Final Trials, in Old Hay, at Stack.											
July 4	15	Warnes[3] . .	3806	35	0	27	557	5·50	9·55	9	0	1	8
,,	16	Bamber[4] . .	557	15	0[1]	18	560	8·30	9·10	6	0	0	8⅝
,,	17	Hoodless . .	523	24	0	42	668	4·20	9·70	6	0	1	5

[1] Price, including cart. [2] Density deficient. [3] Second prize. [4] First prize.

output, power, and cost of labour, and his density was well above the requirement in hay; while Warnes, in spite of his double-geared screw, could no more than Bamber obtain the specified density in straw. On the other hand, Bamber's machine was not one-twelfth the weight, and only one-third the price, of Warnes's Press. Without computation of the points due to each machine, the result was in no way doubtful, and, after such computation, Bamber was easily ahead. The First Prize in Class 3 fell, consequently, to Bamber, and the second, *faute de mieux*, it must in all candour be said, was awarded to Warnes.

Trials of Old Hay Presses worked by Hand-Power.—Class 4.

The trials in Class 4 commenced on July 4, and were completed on the same day. Nine machines came forward for trial, viz.:

Bradbury . . .	No. 562	Scott	No. 522
Bamber	„ 557	Barford & Perkins . .	„ 2264
Stephenson . . .	„ 3822	Warnes.	„ 3808
Barford & Perkins . .	„ 2263	Foster	„ 3802
Ladd	„ 3817		

On completion of the first trials, which took place upon hay cut from a stack on Lord Middleton's estate, four machines, viz., Bradbury, Bamber, Barford, and Warnes, received a second trial, upon the results of which the decisions were given. Preliminary runs, of which no account was taken, were given as before, that makers might ascertain if their presses were in working order.

Before describing the trials proper, something must be said about hay in the stack, and something also about this particular hay-stack. The density of hay in a stack differs, of course, very greatly in its upper and lower layers, so that the performance of any old hay press is largely influenced by the position in the rick from which trusses are cut. A truss cut, for example, from the upper part of Lord Middleton's stack, and having a capacity of 13·66 cubic feet, weighed 85 lbs., or 6·22 lbs. to the cubic foot; while another truss, from the bottom of the rick, having a capacity of 12·8 cubic feet, weighed 152 lbs., or 11·9 lbs. to the cubic foot.

Under these circumstances, great care was taken that every competitor should have fair play, and all be served as nearly as possible alike. Mr. Scotson, whose practical knowledge rendered him just the umpire for the purpose, stood by during the whole of the trials in Class 4, directing exactly where each truss should be cut, and, so far as was possible in a case of some difficulty,

seeing that justice was done to each press. Even so, it must be remembered that the tabulated outputs and densities in Class 4 are not so exactly comparable as in classes where loose hay and straw were baled.

Article No. 562 (Fig. 9, p. 607), exhibited by *Joseph Bradbury*, Charles Street, Manchester, was a press in which a suspended platten, balanced by counterweights, is pulled down upon the stuff to be baled by the action of a long lever, acting through a ratchet and gearing upon a pair of chain-barrels situated beneath the floor of the press.

The lever imparts an intermittent motion, by means of a pawl and ratchet-wheel, to the spindle of a pinion which gears, with a ratio of 4 to 1, into a wheel keyed on the chain-barrel shaft. A second (bevil) pinion, gearing into a second set of teeth cast on the same wheel, and operated by a winch, serves to give a quick motion to the chain-barrel shaft at the beginning of pressing; the man in attendance then throws the quick motion out of gear, and completes the operation by some strokes of the lever, on which he finally hangs all his weight. The bale is tied with cord in the usual way, and the platten, on being released, is raised by counterweights, a simple but ingenious arrangement of "snail" pulley on the shaft forming the axis of the counterweights, lifting the platten higher in front than behind, and opening the press widely for the admission of a second charge of hay.

The ratio of movement between the end of the lever and the platten at the moment of greatest pressure is 120 to 1. A man and a boy worked this machine, but the man only gave the pressure, so that, assuming his weight to be 140 lbs., this would equal 7·5 tons pressure on the platten.

This machine worked extremely well; it gave a good, though not relatively high, density, was easy work for a man and boy, and made a good output. The condition of the hay in the bales was, of course, unaltered from that of the stack, and this was the case with all the machines in this class. The cost of baling was low, and the machine altogether a very satisfactory one. It was quickly and easily mounted for travelling, or dismounted for going to work, an operation which only occupied a few minutes.

Perhaps there are more parts and more mechanical complexity than need be in the Bradbury Press, but it is one which would assuredly give satisfaction to any farmer employing it. The machine might have obtained more points, had Bradbury cut his trusses larger; and, indeed, it would have been better had each competitor been obliged to cut a given sized truss from the stack. But this was a matter manifestly outside the control of the Judges, who could only say to all the competitors, "Go as you please, and show your machine to the best advantage," while exercising their judgment as to whether any trusses were, or were not, too large to be practical.

Article No. 557 (Fig. 6, p. 606), exhibited by *Joseph Bamber*,

of Preston, was the same press as that (see page 587) which competed in Class 3, and will not, therefore, be again described. The machine worked extremely well in the old hay, making a good output, and giving a high density. The cost of baling per ton was less in the final trials than that of any other machine in the class, the work was easy for the two men employed, while the extreme simplicity of the machine and its very moderate price recommended it in the strongest way to the Judges. Bamber's machine, as already described, is moved from place to place on a simple hand-cart, into which it can be loaded in two minutes.

Article No. 3822, exhibited by *George Stephenson*, of Newark-on-Trent, was constructed, like all of Stephenson's machines, on the "toggle-joint" principle—the toggles, in this case, having no lower limbs, and the upper limbs being provided at their lower extremities with rollers running upon rails, which serve to form the sole plate of the press.

The toggles are pulled together by a chain, wound round a barrel by means of a long lever and ratchet-wheel, which turns a bevel pinion gearing into a wheel, giving a considerable decrease in speed.

The ratchet-wheel is double-acting, giving motion to the chain-barrel on the upward as well as on the downward stroke. The platten in this, as in all Stephenson's presses, is placed below, and receives an upward thrust. It is furnished with a lateral slide, which, being pulled out, gives a free head-way for piling the loose hay, and is afterwards pushed back into place ready to receive the pressure. After pressing, the platten and bale are allowed to fall by their own weight, the speed of descent being controlled by a small brake.

The ratio of movement between the extremity of the lever and that of the platten at the point of maximum pressure is 162 to 1, or, taking the man's weight at 140 lbs., 10·1 tons upon the platten.

This machine failed; chiefly for want of range in the press. Stuff enough could not be put in to get the full pressure on the bale, and a density of only 6·3 lbs. to the cubic foot was obtained. The press exhibited evident signs of being a "first machine," and it was matter for regret that, except in one case, Mr. Stephenson should have shown presses not yet perfected, for it appeared probable that, in the toggle, he has got hold of a principle very applicable to hay and straw pressing. This machine was excused from second trial.

Article 2263 (Fig. 8, p. 607), exhibited by *Barford & Perkins*, Peterborough, is similar in principle to that of Bradbury, already described, but employs a longer hand-lever, which works directly, instead of through gearing, upon a ratchet-wheel keyed to a spindle passing under the floor of the press, and furnished with two "snail" chain-barrels.

As these are rotated by the action of the lever, the platten is pulled down, quickly at first, and slowly at last, and is returned, after compression

has been effected, by counterweights. The platten is guided in its descent by two rollers, one on each side of the machine; an arrangement which, leaving the platten free to accommodate itself to the surface of the bale, avoids the friction common to guides, which keep it horizontal. The floor of the press slides out laterally for taking a charge of hay. It is then pushed back, the platten being, meanwhile, at its greatest height.

Three men tended this press, which worked rapidly and well, turning out bales of the requisite density, and without at all distressing the men, who could undoubtedly go on all day at the work. The ratio of movement between the hand-lever and the platten at the moment of greatest pressure is 36 to 1, and the two men employed in pressing were ascertained to weigh together 298 lbs., which equals a pressure of 4·8 tons on the platten.

It will be noticed that these exhibitors do not aim at giving the heavy pressures which many others do to the bale, but, in view of the fact that the press accomplishes its object, viz., loading 50 cwt. into 25 cubic yards, a clear gain in speed and cost is obtained by this policy. The same thing is true of the Bamber screw-press, wherein sufficient pressure is given without a second motion, while hand-presses, furnished with gears, appear merely to "butter bacon" at the expense of output and economy.

Article 3817, exhibited by *H. Ladd & Co.*, of Queen Victoria Street, London, would have made a better showing but for the obvious fact that it had only recently been finished, apparently for the purpose of competition, and that it embodied certain crudities of detail, such as are inseparable from "first machines." The floor of the press supports two vertical wrought-iron racks, while the platten is furnished with a winch operating a gear having two movements. Winch and platten descend together, so that the operator, who begins by turning a handle about as high as his head, finds this, at last, when the pressure is being put on, at a convenient height for exerting all his power. After pressing, the winch is slid out of gear, and the platten returned quickly by means of a temporary handle slipped into a socket in the first motion-wheel. The ratio of movement between winch and platten at the moment of maximum pressure is 205 to 1, or with one man, exercising 50 lbs. pressure on the handle, about 4·5 tons total pressure on the platten; with two men, 9 tons. The machine did not obtain the required density, and was excused from a second trial.

Article 522 (Fig. 10, p. 608), exhibited by *Elton Scott*, of High Street, Lincoln, was next tried.

Scott's Press is cart-like in appearance, and is set to work by removing a pair of travelling wheels and up-ending the

shafts. When on the road, the attendant sits on the press as in a cart, and drives the horse. When at work, the press-body is vertical and the platten below. The latter is furnished with a lateral slide for receiving the charge of hay, and it is raised, by means of ropes wound upon a barrel, operated by a winch and gear of two movements. When the pressing is completed, the platten falls by its own weight, the winch being slipped out of action, and its too rapid descent is checked by a brake under control of the attendant. The ratio of movement between winch and platten at the moment of maximum pressure is 256 to 1, or, with one man exerting 50 lbs. pressure on the winch, 5·7 tons on the platten, and 11·4 tons when two men press. The press did not obtain the required density, and was excused from a second trial.

Article No. 2264, exhibited by *Barford & Perkins*, of Peterborough, was a duplicate of No. 2263, already described, with the addition of a device for weighing the hay before baling, and thus ensuring uniform trusses. The design of the steel-yard is simple, adding little to the complexity of the machine, and not in any way inconveniencing the men. The weighing device unfortunately failed in the trial, not on account of any inherent defect, but simply because the notches for carrying the steel-yard weights were too shallow. The shaking of the machine when at work shifted the weight, and gave all sorts of results. The case again illustrates the danger of putting a "first machine" into trial. This press was excused a second trial.

Article 3868, exhibited by *William Warnes*, of King's Lynn, was practically a duplicate of the press tried in Class 3 (see page 589). Warnes's Press was now, however, in presence, not only of the machine which had beaten it in Class 3, but of several other much more formidable competitors than it had met in that class, and, although it was ordered for second trial, its chances of final success were not great.

Article 3802, exhibited by *William Foster & Co., Limited*, of Wellington Foundry, Lincoln, was a double-acting machine, consisting of a platten moving vertically between the floor and the roof of the press, matters being so arranged that the top press received a charge while the bale, previously formed below, was being tied.

The platten is operated by two vertical screws, standing one on either side of the machine, which do not themselves revolve, but are furnished with nuts, toothed peripherally, and actuated each by a tangential screw, as in the well-known "Haley" screwjack.

The ratio of movement between the platten and winch-handle is 480 to 1, equal to a pressure of $10\frac{3}{4}$ tons on the platten, one man turning the handle—or double this with two men turning.

In spite of its great apparent power, this press failed to obtain the required density, but this was due to a want of room in the press-body, and not to want of power. The movement of the platten was limited by a certain guide-wheel, so that it could not approach its abutment within 18 inches, while there was not room in the press-body for loose hay enough to give the required density without more movement of the platten. The press, which, from a mechanical point of view, was very satisfactory, being well-made, simple, strong, and not liable to get out of order, was excused a second trial.

Final Trials of Old Hay Presses worked by Hand-Power. *Class 4.*

These commenced on July 5 with a second trial of Bradbury's machine, followed by Bamber, Barford, and Warnes. Such variations as took place from the performances of each of these machines in the first trials were slight, and are dealt with in the tables below. The competition between Bamber and Barford was very keen, while Bradbury also pressed both of these machines hard. So far as the two former presses are con-

TABLE VI.—SHOWING GENERAL RESULTS OF TRIALS IN CLASS IV.

Date of Trial	Order of Trial	Name of Exhibitor	Catalogue number	Price of machine	Duration of trial	Weight of bales made	Tons baled per day	Mean density of bales	Cost of labour per day at 3*s.* per man		Cost of baling per ton	
		First Trials in Old Hay at Stack.										
				£	min.	lbs.	tons	lbs. per c. foot	*s.*	*d.*	*s.*	*d.*
July 4	18	Bradbury . .	562	19	19	428	6·0	8·5	6	0	1	0
"	19	Bamber . . .	557	15	24	485	5·4	7·3	6	0	1	1½
"	20	Stephenson . .	3822	25	25	355	3·8	6·3	6	0	1	7
"	21	Barford . . .	2263	25	11	500	12·1	11·2	9	0	0	9
"	22	Ladd	3817	12	14	472	9·0	7·6	6	0	0	8
"	23	Scott	522	25	20	468	6·3	7·3	6	0	0	11½
"	24	Barford . . .	2264	29	14	510	9·7	7·6	9	0	0	11
"	25	Warnes . . .	3808	35	30	553	5·0	9·5	9	0	1	9½
"	26	Foster	3802	20	21	472	6·0	7·7	[illegible]	0	1	0
		Final Trials in Old Hay at Stack.										
July 4	27	Bradbury . .	562	25	24	674	7·5	8·31	6	0	0	9½
"	28	Bamber[1] . . .	557	15[3]	35	1021	7·8	9·71	6	0	0	9¼
"	29	Barford[2] . . .	2263	25	22	830	10·0	9·80	9	0	0	10¾
"	30	Warnes . . .	3808	35	43	948	5·8	11·0	9	0	1	6½

[1] First prize. [2] Highly commended. [3] With cart.

TABLE VII.—SUMMARY OF RESULTS OBTAINED BY THE PRIZE MACHINES IN ALL CLASSES.

Class	Name of Exhibitor	Prize awarded	Loose Straw				Loose Hay				New Hay				Old Hay			
			Output per day	Density per c. foot	Power absorbed (I.H.P.)	Cost of baling per ton	Output per day	Density per c. foot	Power absorbed (I.H.P.)	Cost of baling per ton	Output per day	Density per c. foot	Power absorbed (I.H.P.)	Cost of baling per ton	Output per day	Density per c. foot	Power absorbed (I.H.P.)	Cost of baling per ton
			tons	lbs.		s. d.	tons	lbs.		s. d.	tons	lbs.		s. d.	tons	lbs.		s. d.
1	Ladd . .	1st	14·0	10·7	5	1 2½	28·8	15·4	5	0 7	33·4	23·0	5	0 6				
	Samuelson	2nd	7·1	13·4	5	1 11½	11·4	19·7	5	1 2½	18·1	26·4	5	0 9				
2	Stephenson	1st	8·5	8·6	Horses 1	1 9	13·5	14·1	Horses 1	1 1								
	Ladd . .	2nd	8·0	10·4	2	3 1	10·5	13·4	2	2 4								
3	Bamber .	1st	4·2	4·2	Men 2	1 5	4·0	9·7	Men 2	1 6	—	—	—	—	8·3	9·1	Men 2	0 8½
	Warnes .	2nd	3·2	5·1	3	2 9	4·5	8·4	3	2 0	—	—	—	—	5·5	9·5	3	1 8
4	Bamber .	1st	—	—	—	—	—	—	—	—	—	—	—	—	7·8	9·7	Men 2	0 9¼
													Final trials					
	Barford .	Highly commended.				—	—		—	—	—	—	—	—	10·0	9·8	3	0 10¾

cerned, it was a case in which a decision would hardly have been possible without the aid of "points," and these, after a most careful allotment, gave the First Prize to Bamber. So few points, however, divided the first from the second machine that the Judges recommended Messrs. Barford & Perkins for a second prize—there being only one prize of 20*l.* offered in this class—and, upon the Council announcing their inability to make any change in the published programme, the Judges highly commended Barford & Perkins's Press, coupling this award with the statement that it was made because no further money prize could be awarded by the Council. The effect, however, was to put the press in question closely into the second place.

General Conclusions.

It now only remains briefly to deduce certain general conclusions from these trials, and to notice some extraordinary discrepancies in the practice of the various makers—discrepancies which, while they tend to show that the art of press-making is in its infancy, prove also that, whatever may be thought of the prize system generally, its application to machines still in course of development benefits both users and makers. There is no way, indeed, short of the slow process known as the "survival of the fittest," whereby any mechanical device is ultimately perfected, but the advantage of such trials as those at Nottingham resides in the fact that artificial selection aids natural selection, and brings the "fittest" sooner into being.

So far as Class 1 is concerned, it has already been pointed out that both the Ladd and Pilter Presses are wasteful of power, and the cause of this wastefulness has been explained. The uneven character of the load imposed upon the engine by the Foster Press has been dwelt upon, together with the fact that this machine calls for a more powerful engine than would be needed if its demands for energy in relation to the work accomplished were more constant. On the other hand, the Howard Press, with all its crudities, did not throw away power, like the Ladd and Pilter Presses, on the extrusion of the trusses, for, if it thrust its hay or straw sausage forth intermittently, little or no loss of power was thereby occasioned, because the inertia of the issuing stream was trifling. This intermittence itself would probably disappear by the adoption of an automatic binding apparatus, with the addition of which apparently feasible improvement the Howard Press has a future before it.

In the 2nd, or Horse-power Class, Ladd's weak point came into strong relief when his press was brought into competition with that of Stephenson. A great part of his horse-power

was manifestly used, not to compress, but to discharge his bales, while Stephenson showed that one-fourth of a horse-power, properly applied, is enough to do more work than Ladd accomplished with one horse, or could, probably, have accomplished with two. Immature as, unfortunately, were all the machines exhibited by Stephenson in other classes, his performance in Class 2 demonstrated that "toggle-joint" machines are very economical of power, and therefore of time and money. It remains for Mr. Stephenson, or some other maker, to give a better practical expression to this principle than, aside from the horse-power machine, was forthcoming at his hands at Nottingham.

Turning now to the hay and straw presses worked by hand-power (Classes 3 and 4), the following table discloses not only some extraordinary differences in the present practice of makers, but the fact that the principles which should govern the art of hay and straw pressing are as yet little understood. Several machines have been omitted from the table in question, some because they failed altogether, others because they were not worked up to their powers, and others, again, because they were disqualified or withdrawn; but enough remains to startle the mechanic as well as to give him hints which ought to guide future construction.

TABLE VIII.—HAY AND STRAW PRESSES WORKED BY HAND-POWER.—CLASSES 3 AND 4.

Catalogue number	Name of exhibitor	Lever	Winch	Ratio of leverage to 1	Pressure on platten (disregarding friction)	Mean density obtained (in hay)
					tons	lbs. per c. foot
3090	McKenzie .	×		$16\frac{1}{2}$	2·0	4·1
2263	Barford . .	×		36	4·8	9·8
562	Bradbury .	×		120	7·5	8·3
557	Bamber . .	×		120	10·7	9·7
523	Hoodless .		×	372	16·0	9·7
3802	Foster . .		×	480	21·7	7·7
3808	Warnes . .		×	883	39·0	11·0

Now, in view of the fact that all these presses simply aim at getting 50 cwt. of hay or straw into a railway truck, and that this can be accomplished by squeezing something less than 8 lbs. of either material into a cubic foot, it is clear they cannot *all* be built upon correct principles.

The stack of old hay operated upon at Nottingham had, itself, a density of 6 lbs. per cubic foot at top, and 12 lbs. at bottom, and, although a good deal of density is no doubt lost in cutting out trusses, there is not really much work to be done in old hay pressing.

It is true that McKenzie's Press, with a leverage of $16\frac{1}{2}$ to 1, failed to obtain the required density, but Barford succeeded in doing all that was wanted with a leverage of 36 to 1. Meanwhile, at the other end of the scale, Warnes, with a leverage of 883 to 1, got only a little more density than Barford, losing speed and time correspondingly, and needing a mammoth frame to withstand useless strains.

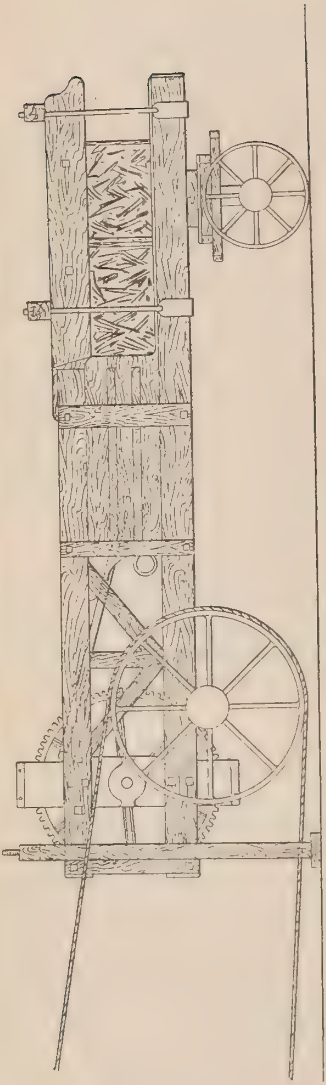
This Report does not, of course, pretend to say where the "happy mean" between these extremes lies; its duty ceases with pointing out discrepancies in practice which, before trial and examination, no one would have suspected. If Barford's pressure of something under 5 tons upon the platten is enough to do the work required from an "old hay press," machines which aim at obtaining from twice to eight times this platten pressure cannot possibly be the "fittest," and will, probably, not "survive."

Similarly, the Bamber Press weighed less than three cwt., while the Warnes Press must have weighed nearly as many tons; yet, such was the chaos of principles, and such the exigency of the situation in Class 3, that the Judges had no choice between giving the Second Prize to the Warnes machine or withholding it altogether. This is faint praise for those machines which failed in Class 3, but it is solid fact.

Surely, never was an occasion when unexpected results, such as those which followed the Nottingham trials, formed a better justification of the modified prize system as it exists to-day. The mere tabulation of those results is itself an education to makers who are, probably, learners of the art, not to say the "mystery," of press-making.

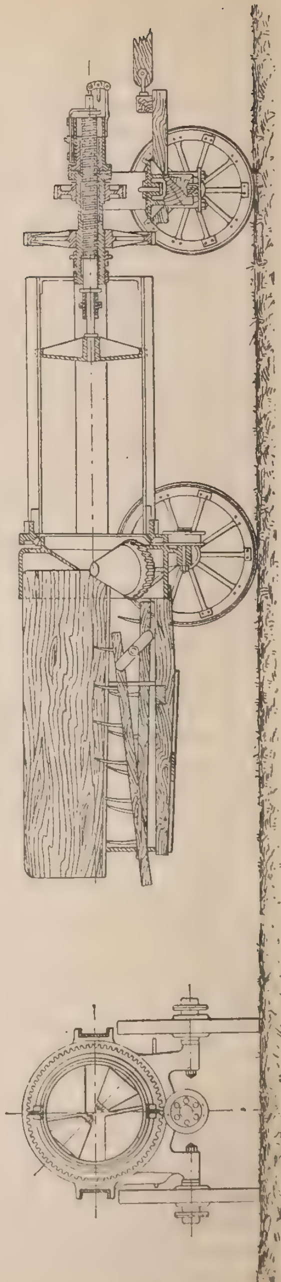
A last, and pleasant, duty remains—viz., to acknowledge, on the part of the Judges, the willingness—and, it might on this occasion be added, the patience—with which all their demands upon the exhibitors were met; the value of the technical assistance afforded by Mr. Anderson, Mr. Courtney, and their assistants; and the services of that faultless implement steward, Mr. Hemsley, in foreseeing and providing for every possible want. Three other less conspicuous aids to the Judges' labours require acknowledgment: Mr. Avery's kindness in lending weighing machines; Messrs. Aveling's courtesy in putting one of their engines at the disposal of the Judges for more than a week; and, finally, the services of Metcalfe, Messrs. Aveling's engine-driver, who won the admiration of all the Judges by the quiet, skilful way in which he placed and handled his engine, and the ready politeness with which he fulfilled their every request.

Fig. 1. Ladd's Hay and Straw Press.
(*Awarded First Prize in Class 1 and Second Prize in Class 2.*)



Side Elevation.

Fig. 2. Samuelson's Hay and Straw Press.
(*Awarded Second Prize in Class 1.*)

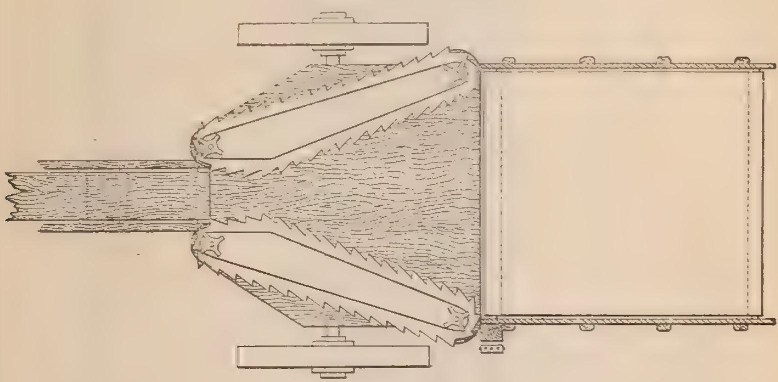


Longitudinal Section.

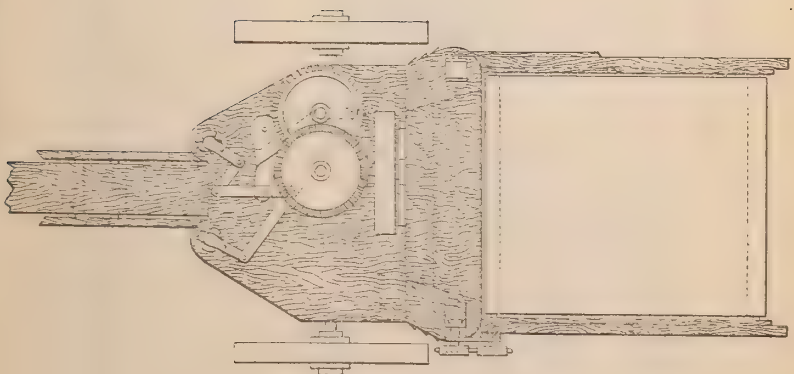
End View.

Fig. 3. Howard's Hay and Straw Press.

(*Class* 1.)



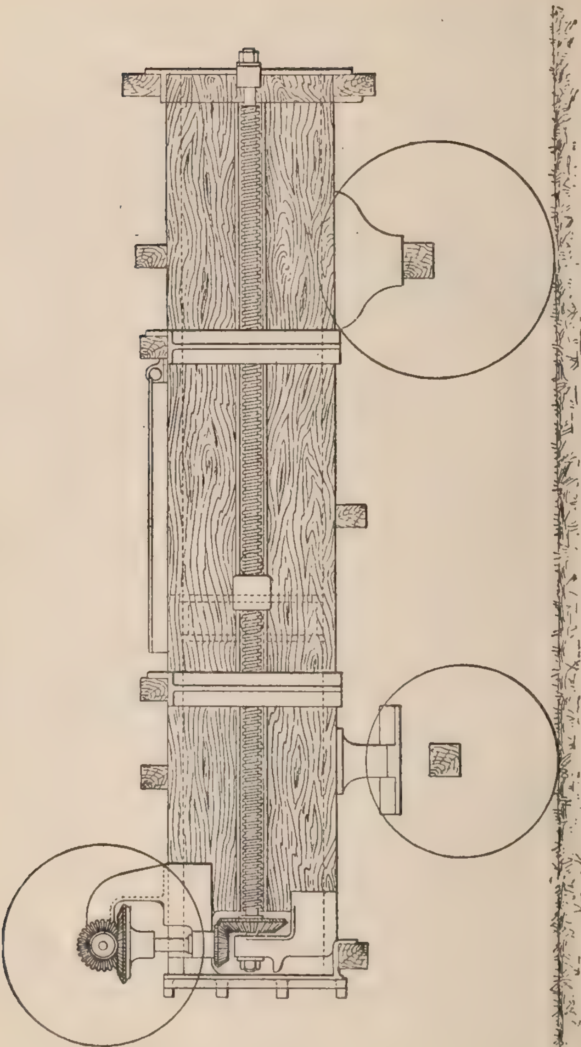
Sectional Plan.



Plan.

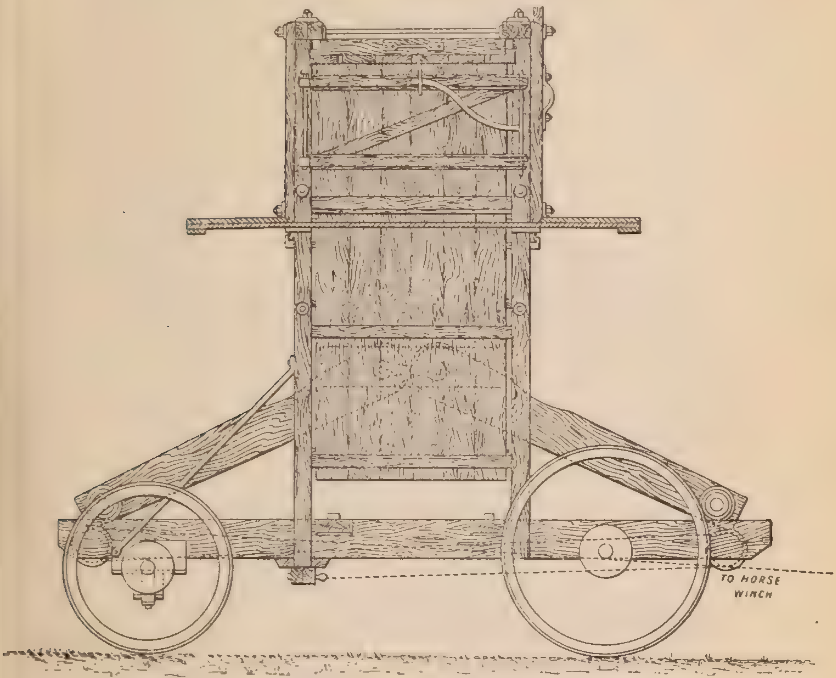
Fig. 4. Foster's Hay and Straw Press.

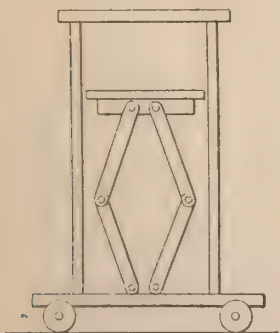
(*Class* 1.)



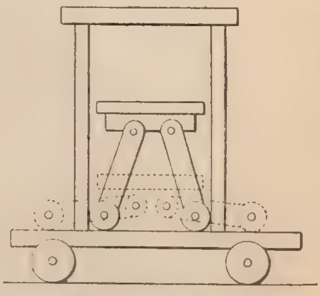
Side Elevation.

Fig 5 STEPHENSON'S HAY AND STRAW PRESS.
(*Awarded First Prize in Class* 2.)





WHOLE TOGGLE MACHINE.



HALF TOGGLE MACHINE.

(*See text, page* 581.)

Fig. 6. Bamber's Hay and Straw Press.
(*Awarded First Prize in Classes 3 and 4.*)

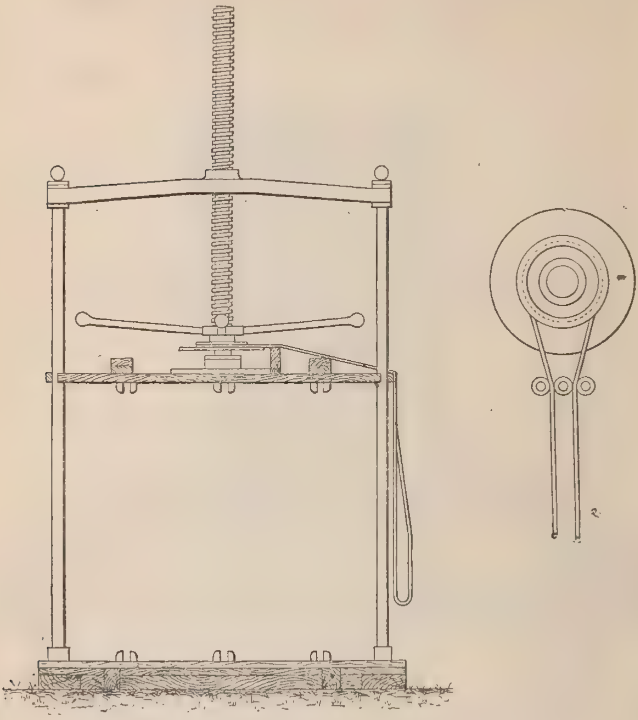


Fig. 7. Warnes' Hay and Straw Press.
(*Awarded Second Prize in Class 3.*)

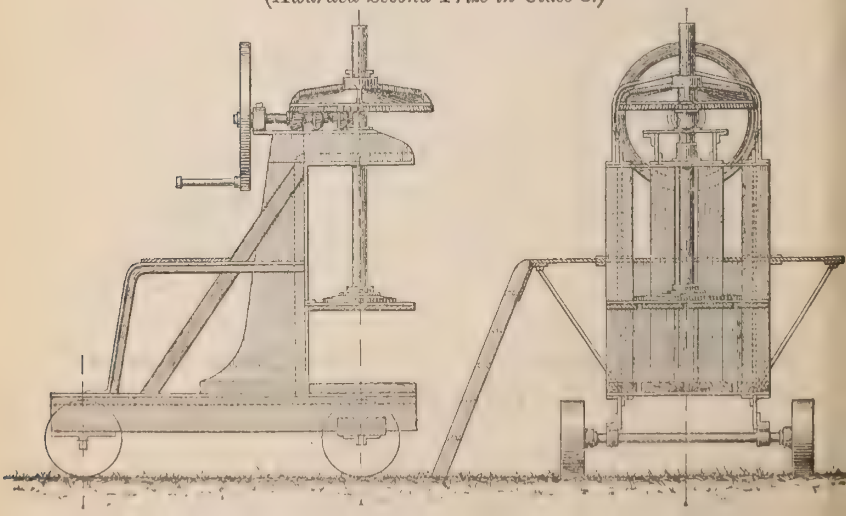


Fig. 8. Barford & Perkins's Old Hay Press.
(*Highly commended in Class* 4.)

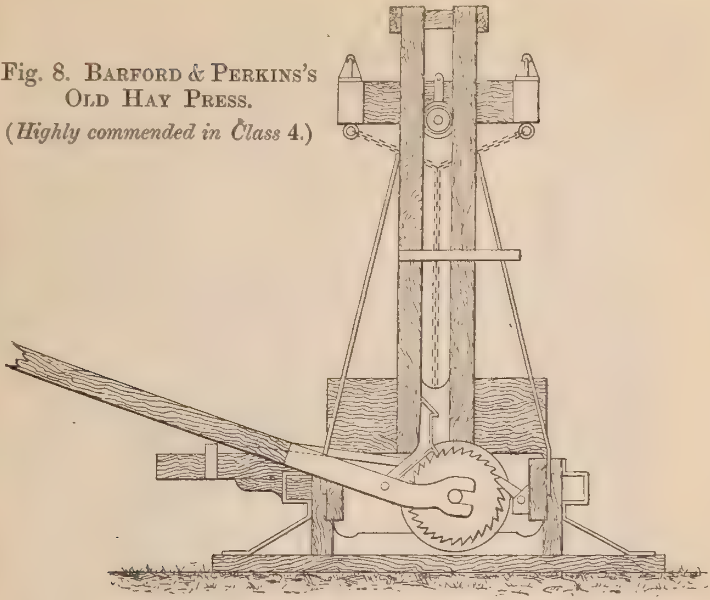


Fig. 9. Bradbury's Old Hay Press.
(*Class* 4.)

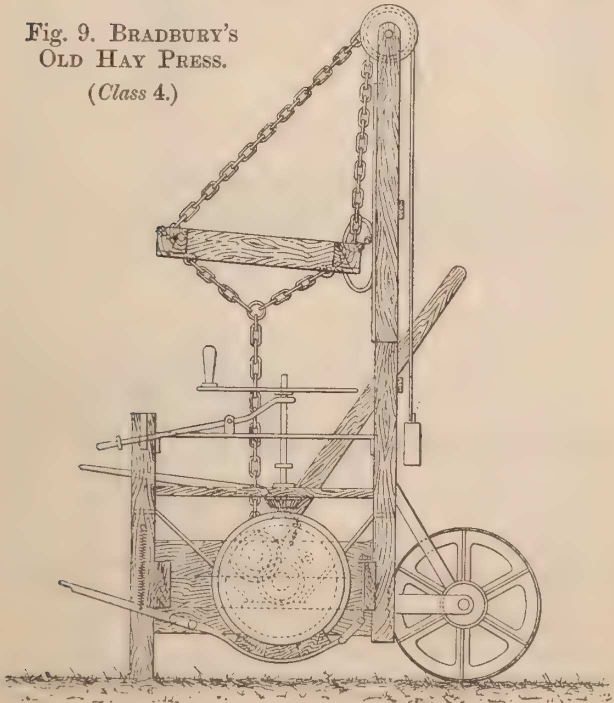
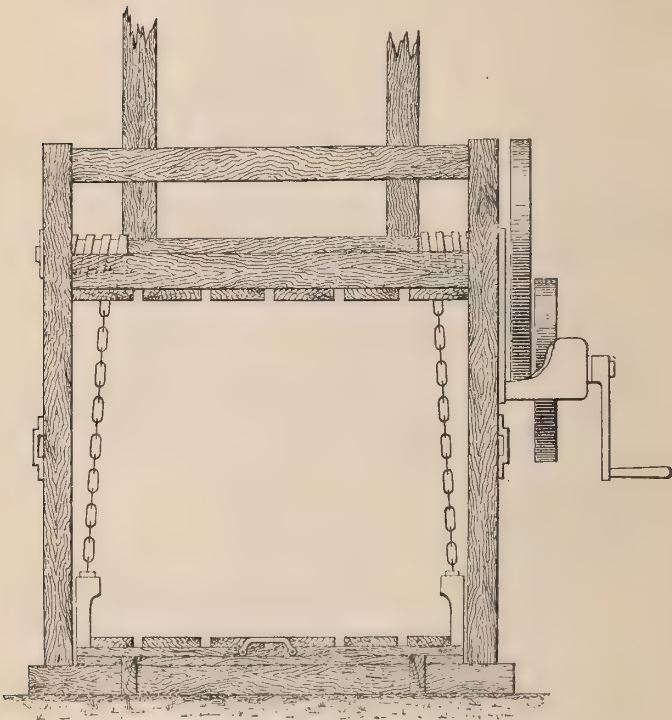
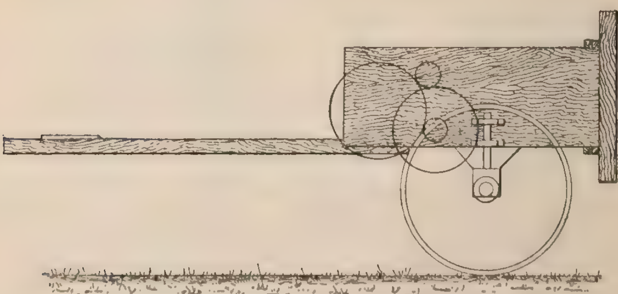


Fig. 10. Elton Scott's Old-Hay Press
(*Class* 4)
As arranged for work.





The same, as arranged for travelling.

XXX.—*Report of the Senior Steward of Live-Stock at Nottingham.* By Viscount Emlyn, Golden Grove, Carmarthenshire.

The 49th Annual Show held at Nottingham in last July may be fairly considered to have been a success, whether we look merely to the number of exhibits, to their quality, or to the number of visitors who attended the Show throughout the week.

The Show-yard, situated in Lord Middleton's park at Wollaton, was as convenient for its purpose as could well be wished. The soil was such that the ground remained firm and dry in spite of the heavy rain that fell during part of the week, and the trees that were grouped in different parts of the yard added much to the beauty of the scene.

Though the weather was cold and stormy at times, and one night was rough enough to cause some discomfort to both animals and their attendants, yet on the whole the weather did not interfere to any material extent with the success of the meeting.

In the memory of all those who had any share in the management of the Show there will ever be prominent a grateful recollection of the generous welcome to Wollaton Park that was given to the Society by Lord and Lady Middleton, of the kindly hospitality extended by them to many of its members, and of the warm interest taken by them in all that affected the success of the Show. To them the Society is indebted in no ordinary degree.

The warmest thanks of the Society are also due to the local committee, to their indefatigable Secretary Mr. Barron, and to Mr. Wright (who kindly undertook the arduous duties of Steward of Forage), for their active and most willing help, and to the Mayor of Nottingham, Mr. Alderman Turney, for the hospitality he extended to the members of the Society. Mention must also be made of the courtesy and efficiency with which the Midland and other Railway Companies provided the necessary accommodation for the conveyance of both visitors and stock to and from the Show.

Of late years it has been the privilege of the Royal Agricultural Society to be able to record the presence of H.R.H. the Prince of Wales at many of the Shows, and we recognise with gratitude the interest that he has taken for many years in the well-being of the Society. It was therefore with deep regret that those who were interested in the success of the Show at Nottingham learned that it would not be possible for the Prince to fulfil his intention of being present. But while it is impossible to conceal the disappointment that was felt in every

quarter at the enforced absence of His Royal Highness, it is with respectful sympathy that we would claim to join in the universal feeling of regret at that which caused his absence —viz. the death of one of the noblest of sovereigns, one of the best of men. That there may be, at the date of the Society's next meeting, no cloud of sorrow in the Royal home is our most earnest hope.

On Saturday, July 7, the exhibition of implements commenced, the stock-yard being opened, as on recent occasions, on the Monday following, an arrangement which appears to be admitted both by exhibitors and officials of the Society to be the most convenient.

On Sunday the 8th, the usual service was held in the Show-yard, the sermon (which few who heard it will readily forget) being preached by the Bishop of Adelaide.

On Monday the judging of stock was commenced at an early hour, and in spite of some heavy showers the Judges were able to get through their work without serious inconvenience.

This being the first meeting that the Society has ever held in Nottingham, it is not possible to compare the results of former meetings in the same town with that of the current year, as has sometimes been the case; but we can indicate to some extent the progress made in the number of exhibits at our Shows, and of visitors attending them, by comparing the numbers this year with those at Newcastle in 1887, and also with those at Lincoln in 1854, Leicester in 1868, and Derby in 1881, as below:—

Year.		No. of Entries of Stock.	No. of Persons admitted.
1888.	Nottingham	1,877	147,927
1887.	Newcastle	1,833	127,372
1881.	Derby	1,229	127,996
1868.	Leicester	994	97,138
1854.	Lincoln	735	37,635

On reference to past records it will be found that the entries of stock for this year's Show are the largest for any year since the foundation of the Society, with the exception of those for Battersea in 1862, and London in 1879, when the numbers were respectively 1,986 and 2,879; whilst it may be mentioned that the number of visitors paying for admission to the Show-yard on one day (Thursday) in the Show week, amounting to 88,832, has never been equalled at any Show the Society has ever held.

The following tabular statement of the entries of stock for the Nottingham Meeting, as compared with the eight previous years, may be found interesting:—

—	Nottingham, 1888	Newcastle, 1887	Norwich, 1886	Preston, 1885	Shrewsbury, 1884	York, 1883	Reading, 1882	Derby, 1881	Carlisle, 1880
Horses . . .	546	500	493	438	407	611	239	256	487
Cattle . . .	646	626	681	539	579	462	598	392	434
Sheep . . .	537	513	446	433	490	412	442	414	434
Pigs	148	194	203	203	211	200	188	167	146
Total . .	1,877	1,833	1,823	1,613	1,687	1,685	1,467	1,229	1,501
Poultry . .	343	405	191	325	—	—	—	—	—

It will be seen from this table that there were 546 Horses entered, which is the largest total since Kilburn, with the single exception of York (1883). The Cattle numbered 646, the largest entry of recent years, with the exception of Norwich, when there were 681. Of the 646 entries, 158 were Shorthorns. The Sheep were more numerous than on any occasion during the last nine years, there being 537 entries. Pigs numbered 148, which was a smaller entry than usual. In all, there were 1,877 entries of live stock, as against 1,833 at Newcastle, 1,823 at Norwich, and 1,613 at Preston. The entries of Poultry numbered 343, as against 405 at Newcastle, 191 at Norwich, and 325 at Preston, when the Poultry Show was first instituted.

For some years past it has been customary to entrust the duty of reporting upon the Live Stock exhibited in our Show-yards to an Official Reporter, appointed *ad hoc* by the Council. One Show being now very much like another, it had become increasingly difficult for the gentlemen selected for this duty to infuse any element of novelty—it may even be said of interest—into these reports; and inasmuch as the Official List of the Awards, with the name of the animal, its exhibitor, breeder, and pedigree, is given in full in the Appendix of the Journal, whilst the reports of the Judges are also printed *in extenso*, the Council decided that, for this year at all events, they would leave to the retiring Steward the responsibility of making such general remarks as to the Stock exhibited as appeared to him to be called for.

This task having devolved upon me, I think I shall best fulfil the wishes of the Council by referring readers of the Journal to the Judges' Reports which I append, and, amongst these, I should like specially to draw attention to the remarks by Mr. Walter Gilbey and his colleague on the Jersey Cattle, which for ability and completeness leave nothing to be desired.

All that I need add here, is that among the Horses, those calling for especial notice were the three classes of fillies, and

the stallions foaled in 1886 and 1887 amongst the Shires; the yearling fillies among the Clydesdales; and all the younger classes amongst the Hunters, notably two-year-old geldings, which are mentioned by the Judges as being as good a class of two-year-olds as ever appeared in a show ring. This improvement in the younger class of hunters cannot but be a source of great encouragement to those who for many years have been endeavouring to improve this class of horse.

Hackneys and Ponies were much above the average. In the harness classes the entries were but few, and confined to "old prize takers, with perfect action and very bad to beat." It might be worthy of consideration whether the adoption of the recommendation of the Judges with reference to prizes in these classes might not lead to increased competition and to larger entries.

Among the Cattle the Shorthorns were good, especially the winners in the classes for cows. The Hereford exhibits have perhaps never been surpassed for merit. The Jersey classes were strong in numbers and of unusual excellence, and the Red Polled cattle were remarkable for the absence of any moderate animals among them.

Sheep were good all through; special attention being called by the Judges to the excellence of the Oxford Downs, while it is satisfactory to notice a clean sheet in the report of the Inspectors of Shearing.

The Breeding Sows of the large white breed are the only class of pigs calling for any special mention, while the large number of disqualifications among the younger classes of white pigs is worthy of remark.

In the report on the exhibition of live stock at Preston in 1885, attention was drawn to the large number of absentees. The regulations as to the time of entry were modified for the Norwich Show, and those that have since been held. Instead of the entries closing on May 1, as in 1885, the date of entry was extended to the 12th, while post entries at double fees were instituted, the final date for which was June 1.

Bearing this change in mind, it is interesting to observe what has taken place since Preston with regard to absentees. Since 1885, amongst the horses they have steadily increased, until this year they reached as high a figure as 27 per cent. of the entries, as against 19 per cent. in 1885—the average for the last three years being 23 per cent. Cattle, which showed in 1885 21 per cent. of absentees, stand this year at 18 per cent. —the average for the last three years being 18 per cent. The sheep, which showed in 1885 a percentage of 11 of absentees,

show during the last three years an average of 15 per cent. Pigs, which were reported as the greatest offenders in this respect in 1885, have since then shown considerable improvement, the average of the last three years being 15 per cent., as against 23 per cent. in 1885, and it is noticeable that the Jersey cattle—which ranked next them in that year—have in like manner steadily improved :—

The following tabular statement of absentees, which has been prepared for me by the Secretary of the Society, will be of interest in connection with this subject.

STATEMENT SHOWING NUMBER OF ENTRIES AND NUMBER OF ABSENTEES (with percentage to Total Entries) AT EACH OF THE LAST FOUR MEETINGS.

—	PRESTON, 1885			NORWICH, 1886			NEWCASTLE, 1887			NOTTINGHAM, 1888			Average Percentage of Absentees during last 3 years (1886–8)
	No. of Entries	No. of Absentees	Percentage of Absentees	No. of Entries	No. of Absentees	Percentage of Absentees	No. of Entries	No. of Absentees	Percentage of Absentees	No. of Entries	No. of Absentees	Percentage of Absentees	
Horses.—													
Shire . .	147	31	21	78	22	28	83	24	29	187	62	33	31
Clydesdale	64	17	27	55	15	27	93	18	19	64	13	20	22
Suffolk . .	21	4	19	98	14	14	21	3	14	37	9	24	17
Thoroughbreds and Hunters .	90	21	23	101	22	22	140	27	19	161	40	25	22
Hackneys .	65	4	6	107	13	12	106	22	20	78	15	20	17
Harness .	13	1	8	43	8	18	—	—	—	19	10	53	29
Others . .	8	1	12	11	1	9	50	14	28	—	—	—	25
Totals	408	79	19	493	95	19	493	108	22	546	149	27	23
Cattle.—													
Shorthorn .	130	29	22	82	20	24	107	12	11	158	35	22	19
Hereford .	76	16	21	73	13	18	66	17	26	57	8	14	19
Devon . .	26	6	23	28	3	11	31	3	10	34	7	21	14
Sussex . .	23	8	35	41	14	34	28	8	29	54	17	31	32
Red Polled	33	7	21	146	18	12	30	2	7	33	3	9	11
Welsh . .	29	2	7	25	1	4	—	—	—	30	3	10	7
Jersey . .	127	35	28	187	45	24	102	13	13	181	32	18	19
Guernsey .	—	—	—	41	3	7	36	4	11	65	11	17	13
Dairy . .	23	3	13	17	11	65	23	4	17	34	3	9	24
Others . .	64	5	8	41	13	32	205	20	10	—	—	—	13
Totals	531	111	21	681	141	21	628	83	13	646	119	18	18
Sheep . .	426	47	11	446	76	17	511	78	15	537	64	11	15
Pigs . . .	198	46	23	203	34	17	193	34	18	148	13	9	15

In face of the present beggarly array of empty boxes, I would submit that this matter is well worthy of attention, when

we consider that in the classes for horses alone unnecessary accommodation had to be provided at Nottingham for some 150 animals. It was commonly rumoured that many sales of horses had taken place a short time before the Show; but this would hardly seem to account for this steady and progressive rise in the percentage of absentees since 1885.

In conclusion I wish to offer my most cordial thanks to all the colleagues with whom I have been associated during my term of office, to the Assistant Stewards (to whose invaluable help and tact we are indebted for any success in our parades of stock and for a very general lightening of our labours), and to the staff of the Society, for their cordial co-operation and generous help in the duties we had mutually to discharge. I can only hope that my successors in office may be as fortunate in this respect as I have been.

Reports of the Judges of the Various Classes of Stock.

Horses.

Report of the Judges of Shire Horses.

[Classes 1 to 4, 15 to 17, 26 to 28.]

Class 1. *Stallions foaled before* 1885.—A very middling class, the First Prize horse (Mr. Freeman-Mitford's *Laughing Stock* [1]) a very good one.

Class 2. *Stallions foaled in* 1885.—The first three good ones, the remainder nothing to note. The First Prize horse (Lord Hindlip's *All Here*) was the champion.

Class 3. *Stallions foaled in* 1886.—This class the best class of stallions we saw.

Class 4. *Stallions foaled in* 1887.—A very good class. Several horses in this class looked like coming to the front another day.

Class 15. *Mares and Foals.*—The first three prize animals in this class had previously won Champion Prizes at the Royal and London Shows, and in this class we had the Champion Shire Mare of the day (Mr. Freeman-Mitford's *Chance*).

Class 26. *Fillies foaled in* 1885.—This class was very good; far superior to any young class we had. We thought we were justified in asking for two additional prizes.[2]

Class 27. *Fillies foaled in* 1886.—This was a very good class, and several very good fillies in it. We also recommended a fourth prize in this class.[2]

Class 28. *Yearling Fillies.*—A good class as a whole.

William Jonas.
John Wills.

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[1] For greater clearness, the names of the animals mentioned, with their owners, have been added to the descriptions given by the Judges.—Ed.

[2] These extra prizes could not be granted by the Council.—Ed.

Report of the Judges of Clydesdale Horses.

[Classes 5 to 7, 18, 29 to 31.]

Classes 5 and 6—*Stallions foaled in* 1885 *and* 1886—were well represented and good, both as to number and quality.

Class 7—*for Yearling Colts*—was small in number, and not of high merit.

Class 18—*Brood Mares*—were, on the contrary, of excellent quality, but short as to numbers.

Classes 29 and 30—*Three-year-old and Two-year-old Fillies*—were also deserving of praise, especially the First and Second Prize animals in each class.

Class 31—*Yearling Fillies*—was an exceptionally good class, and we would call particular attention to the First Prize animal (Mr. R. S. Scott's *Scottish Rose*).

W. S. Park.
Robert Renwick.

Report of the Judges of Suffolk Horses.

[Classes 6, 9, 19, 32, 33.]

We wished all those that entered horses and mares for the Show at Nottingham could have sent them. Notwithstanding, they made a very good show, as compared with other breeds. There were not so many exhibited as at Norwich, which there always ought to be at a Royal Show; but there has been a great demand for 'Suffolks,' and many of the best were sold. We hope that at Windsor, next year, there will be the largest exhibition of them that we have ever had, and that there will be more classes, better prizes, and more of them given, for this pure and old-established breed.

Class 8. *Stallions foaled in* 1885.—There were seven entries only, four of which put in an appearance. No. 119 (Mr. A. J. Smith's *Stockwell*) was first, and No. 117 (Mr. Horace Wolton's *Emperor*) second. The latter is a good sort of a horse, and many outside the ring might consider him the best, but he had that which is very objectionable in any horse, more especially in the 'Suffolks,' which should be quite clean in their legs. No. 118 (Mr. A. J. Smith's *Samson*) was Reserve Number. No. 123 we thought went lame.

Class 9. *Stallions foaled in* 1886.—Ten horses were shown in this class.

Class 19. *Mares and Foals.*—Three mares and three foals only.

Class 32. *Fillies foaled in* 1885.—There were but two entries, and we recommended that a Second Prize should be given to No. 360 (Mr. S. Wolton's *Smart*). No. 359 (Mr. A. J. Smith's *Sally*) we awarded First Prize. Why the owners of three-year-old fillies do not show them we are unable to say, as we know of several quite as good as the two that were exhibited.

Class 33. *Fillies foaled in* 1886.—The best class of 'Suffolks' in the Show, nine entries, and all sent. In addition to the two prize-winners we Highly Commended one animal and Commended all the others.

Arthur Wm. Crisp.
John Mayhew.

Report of the Judges of Thoroughbred Stallions and Hunters.

[Classes 10, 20, 21, 34 to 42.]

Class 10. *Thoroughbred Stallions.*—This was a good class. The winner (Colonel Barlow's *Baldur*) and reserve (Mr. Burdett-Coutts's *Truefit*) were very equal in merit, and it took us some time to decide on their final positions.

Nos. 140 (Compton Stud Company's *Ærides*) and 144 (Mr. Edwin H. Banks's *Moss Hawk*) were well worthy of their high commendations.

CLASS 20—*Hunter Mares and Foals*—was a fairly good class of average merit, but contained nothing of very superior quality.

CLASS 21. *Hunter Mares in Foal.*—Only two mares were entered, but these were exceptionally good in quality, and we therefore specially recommended that the SECOND PRIZE should be given.

CLASS 34. *Weight-carrying Mares and Geldings foaled before* 1884.—This was only a moderately good class. The prize-winners were fairly good, and well known in the Show ring, but as a rule those that possessed good quality were deficient in bone to carry fifteen stone over a strong country.

CLASS 35. *Light Weight Mares and Geldings foaled before* 1884.—This was quite a moderate class, with the exception of the FIRST PRIZE horse (Mr. T. Crutcher's *Huntsman*), which was good, but he was better suited for fourteen than twelve stone.

CLASS 36. *Four-year-old Geldings.*—This was a fairly good class, the FIRST PRIZE horse (Lord Middleton's *Beefeater*) being an exceptionally nice animal.

CLASS 37. *Four-year-old Mares.*—A fairly good class, but small in number: the FIRST PRIZE taker (Mr. John Cooper's *Wandering Maid*) a beautiful mare, and the SECOND (Mr. Jas. S. Darrell's *Brunette*) almost equally good.

CLASS 38. *Three-year-old Geldings.*—This was a good class, the Prize animals being of exceptional merit.

CLASS 39. *Three-year-old Fillies.*—This was a fairly good class, but small in number.

CLASS 40. *Two-year-old Geldings.*—A class of great merit, and large in number. The average merit was perhaps as high as that of any class of two-year-olds that ever appeared in a Show ring. The quality and substance were both excellent.

CLASS 41. *Two-year-old Fillies.*—This was fairly good, but small in number, and calls for no special remark.

CLASS 42—*Yearlings* —was very good, the FIRST (Mr. N. H. Hodgson's *Rumtifoozleum*) and SECOND (Mr. Charles Clarke's chestnut gelding) PRIZE animals being of exceptional quality.

It must be a source of great satisfaction to all those who have been taking an active part in promoting the breeding of hunters, to note the very excellent show of young horses which appeared in the various classes at this Show, denoting as it does that there are mares still left in the country capable of breeding good hunters, and that the distribution of sound well-bred sires is already beginning to bear fruit which it may be hoped will rapidly increase in quality and quantity in the course of a few years.

We cannot conclude our Report without expressing our sense of the admirable manner in which the Stewards of our department performed their difficult task, and lightened our labours by rendering us every assistance in their power.

COVENTRY.
C. RIVERS BULKELEY.
P. ALBERT MUNTZ.

Report of the Judges of Coaching or Cleveland and Harness Horses.

[Classes 11, 22, 43 to 49.]

We considered the FIRST PRIZE takers in each of the classes for coaching, stallions, and mares, the only animals with good action.

There were very few animals in the harness classes brought before us. In Class 47, for animals exceeding fifteen hands there were five entries,

but none put in an appearance. The two other classes were represented by a few animals with perfect action and old prize-takers that go the round of the Shows and are bad to beat. This might be the cause of the short entry.

We recommend the Council to consider if it would not be desirable, in the interest of the breeders and for the purpose of increasing the entries, to make a rule that no animal should take the same prize two years in succession.

We think it would have that effect.

James Hornsby.
Romer Williams.

Report of the Judges of Hackneys and Ponies.

[Classes 12 to 14, 23 to 25, and 43 to 46.]

The Judges, in reviewing the classes which passed under their observation, consider that generally the entries were very creditable, and much above the average. They noticed particularly in Classes 12 and 14 (*Stallions*), 23 (*Mares above* 14.2 *with Foals*), and 43 and 44 (*Mares and Geldings*), that the winners were very superior in appearance, action, and breeding.

The Judges think the Exhibition was one which cannot fail to carry out and encourage the desire and aim which the Royal Agricultural Society have in view for the improvement of this class of horse.

Robert H. Borrowes.
Alfred Ashworth.

Cattle.

Report of the Judges of Shorthorns.

[Classes 50 to 57.]

We have great pleasure in reporting that the classes for male shorthorns were well filled, and showed a high average of merit.

The *Bulls calved in* 1887 (Class 53) formed an unusually numerous class, and we are glad to say that in our opinion the animals show evidence of more robust constitution than has for some time been observable at former Shows. Bulls of practical merit were numerous, and there are many animals likely to improve the stock of the country.

We were struck by the unusual quality of the *Cows*, and we consider the three Prize winners to be magnificent types of shorthorns. The younger classes of *Heifers* were large, and furnished the champion female shorthorn (Mr. R. Thompson's *Belle Madeline*) as well as the Reserve. It will be satisfactory to the Shorthorn Society, which is the donor of the champion prizes, to know that the winners, particularly the old bull, were animals well worthy of the distinction.

As a whole, the show of shorthorns at Nottingham affords a most satisfactory indication of the improvement which is being effected in this leading breed.

Bective.
J. W. Cruickshank.
Jas. How.

Report of the Judges of Hereford Cattle.

[Classes 58 to 66.]

Class 58. *Aged Bulls.*—A remarkably good class, headed by Mr. H. W. Taylor's well-known *Maidstone*, closely pressed by Lord Coventry's *Rare Sovereign*, both bulls possessing extraordinary substance, but having a slightly

overfed appearance. No. 707, the THIRD PRIZE bull (Mr. Richard Edwards's *Magnet*), is of surpassing quality and evenness of flesh, and would have been placed higher but for his weak head and neck.

CLASS 59. *Bulls calved in* 1885.—The FIRST PRIZE, No. 712 (Mr. W. H. Cooke's *Grove Wilton 3rd*), is a bull of great scale, heavy flesh, good quality, and excellent masculine character, a little irregular on top, and faulty in flank. The SECOND PRIZE, No. 713 (the Earl of Coventry's *Rondeau*), is a stylish bull of good quality. The THIRD PRIZE, No. 715 (Mr. Rees Keene's *Three R's*), is a useful stock bull.

CLASS 60. *Bulls calved in* 1886.—FIRST PRIZE, No. 719 (Mr. John Price's *Prince Alfred*), is a remarkably good heavy-fleshed, short-legged, symmetrical bull of beautiful character and quality, and is far ahead of the other exhibits in this class. This bull is also awarded the champion prize for the best Hereford exhibited. The SECOND PRIZE, No. 716 (the Earl of Coventry's *Golden Miner*), is a good level bull.

CLASS 61. *Bulls calved in* 1887.—FIRST PRIZE, No. 720 (Mr. A. E. Hughes' *Royal Head*), is a stylish well-shaped bull of extraordinary scale and superior quality. SECOND PRIZE, No. 724 (Mr. Thomas Fenn's *Downton Wilton*), is an animal with good top and beautiful touch. THIRD PRIZE, No. 721 (the Earl of Coventry's *Royal Ruler*), is a level bull, somewhat plain in his hind quarters.

CLASS 62. *Cows and Heifers calved in or before* 1884.—FIRST PRIZE, No. 735 (Sir Joseph Spearman's *Myrtle 6th*), is an exceptionally good cow of rare quality and nice character, but with rather weak thighs. SECOND PRIZE, No. 729 (Her Majesty the Queen's *Mabelle*), is a capital cow, but not so even as No. 735, and is also deficient in thighs. THIRD PRIZE, No. 734 (Mr. James Rankin's *Fortune-teller*), is a very nice breeding cow, scarcely in Showyard condition, which may be accounted for by her nursing a strong calf.

CLASS 63. *Cows and Heifers calved in* 1885.—FIRST PRIZE, No. 740 (Mr. H. W. Taylor's *Cardiff Lass 2nd*), is a nice-shaped heifer, full of character and quality. SECOND PRIZE, No. 736 (Mr. Ralph Palmer's *Lightfoot*), presses No. 741 very closely, being a very thick heavy-fleshed heifer. THIRD PRIZE, No. 738 (Colonel Bridgford's *Princess*), is also a good animal.

CLASS 64. *Heifers calved in* 1886.—FIRST PRIZE, No. 742 (the Earl of Coventry's *Rosewater*), is a magnificent heifer, possessing great wealth of flesh, of truly symmetrical character. SECOND PRIZE, No. 743 (Mr. J. H. Arkwright's *Ivington Lass 24th*), is a gay stylish heifer, not quite right in the rumps. THIRD PRIZE, No. 744 (Mr. William Tudge's *Lady Wilton*), strongly contested the second honours.

CLASS 65. *Heifers calved in* 1887.—FIRST PRIZE, No. 753 (Mr. Rees Keene's *Blanche Bangham*), is a very heavy-fleshed, beautiful-quality heifer, with a good true back. SECOND PRIZE, No. 748 (Mr. A. E. Hughes' *Princess*), is also a nice shapely-grown heifer, but dips slightly in the back and is not a good handler. THIRD PRIZE, No. 747 (Her Majesty the Queen's *Belle*), is a scaly deep-ribbed heifer, with exceptionally straight under-line. The whole class is of unusual excellence.

CLASS 66. *Bull and two Heifers, all calved in* 1887.—The groups in this Class had a very taking appearance. FIRST PRIZE, No. 758 (Mr. H. F. Russell's *Sir William*, *Dorothy*, and *Queen Bess*), though small, far surpassed the other exhibits in quality and touch, and matched exceedingly well. SECOND PRIZE, No. 760 (Mr. Stephen Robinson's *First Fruits*, *White Spark 6th*, and *Red Spark 6th*), showed great scale but lacked quality. Nos. 759 (Mr. A. P. Turner's *Salisbury*, *Beatrice*, and *Veronica*) and 761 (Mr. John Price's *Provost*, *Patient*, and *Dido*) included animals of great merit, the one heifer in 759 being especially good.

We are of opinion that the exhibits of Hereford Cattle for excellence of quality have never been surpassed, there being a large number of high-class animals, both male and female, of all ages.

SAML. GOODE.
JOHN CRANE.

Report of the Judges of Devon Cattle.

[Classes 67 to 71.]

In compliance with the request of the Council that the Judges of the several departments should make any special comment they may think fit on the merits of the animals brought before them, we beg to say that, considering the great distance they had to be taken from their native home, the different classes of Devons were fairly well filled with specimens which did their owners much credit. And though the names of Quartly, Davey, Turner, and Walter Farthing no longer appear in the catalogue as exhibitors, still, when we have as substitutes and exhibitors Lord Falmouth, Sir W. Williams, A. C. Skinner, and others, it is unlikely that the Royal Society's prizes could be won by Devons undeservedly.

We, therefore, hope that the Society will continue its liberal encouragement to this famous as well as ancient breed of cattle.

In making our awards we were unanimous in our endeavour to give preference to those specimens which had the character, style, air, and quality of flesh mostly resembling a thoroughbred.

We think it best to forbear offering remarks on the comparative points of excellence of the exhibits, beyond expressing our opinion that the FIRST PRIZE animals, particularly in Classes 67 and 69—*Bulls*—and 70 and 71—*Heifers*—though they somewhat lack in size and grandeur, represent, or very approximately so, the correct type and character of the pure-bred Devon.

SAML. P. NEWBERY.
T. BROWN.

Report of the Judges of Sussex Cattle.

[Classes 72 to 76.]

The Sussex Cattle were well represented. In the *Aged Bull* Class (72) there were eight entries. The FIRST PRIZE was awarded to No. 801 (Mr. W. S. Forster's *Mikado*), a well-formed bull of great substance: No. 799 (Mr. Joseph Godman's *Nobleman*) was SECOND, showing good quality and great length, and the THIRD PRIZE winner (Mr. W. Wood's *Oxford 2nd*) is a compact animal of good quality.

There was a good Class (73) of *Yearling Bulls* with twelve competitors. No. 807 (Mr. J. Stewart Hodgson's bull by 'King Rufus') shows substance and quality, and is awarded the FIRST PRIZE. No. 816 (the Earl of Winterton's *Gold*) is a level promising animal, and No. 809 (the Aylesbury Dairy Company's *Clancarty*) is of good substance.

The *Cow* Class (74) had nine entries, four of which were absent. No. 817 (Mr. W. B. Waterlow's *Elsa*) is a grand cow, and may be termed the champion of the breed; No. 819 (Mr. Hodgson's *Laura 7th*) shows substance and quality, and No. 818 (Mr. Louis Huth's *Lilly 2nd*) is nicely formed, not quite so thick in flesh, but of fine quality.

CLASS 75. *Heifers calved in* 1886.—No. 832 (Mr. W. S. Forster's *Parade*) is a good level heifer with nice quality; No. 830 (Mr. Godman's *Comely 9th*) is also of nice quality, and No. 831 (Mr. Forster's *Acorn*) is very useful-looking.

CLASS 76—*Heifers calved in* 1887—has the largest number of entries, viz.

15. The FIRST PRIZE winner, No. 849 (Mr. Barclay Field's *Primrose*), is a good heifer; No. 838 (Mr. C. B. Godman's *Sunset*) is of nice quality, and No. 836 (Mr. Hodgson's *Pride of the Family 7th*) is a very level heifer with fine touch.

ALFRED HEASMAN.
EDWARD VICKRESS.

Report of the Judges of Welsh Cattle.

[Classes 77 to 81.]

The Welsh breed of cattle showed up in considerable force, and were well represented. They show marked improvement on previous exhibitions, many animals of great merit coming before us, especially Nos. 851 (Colonel Platt's *Ap Gwilym*), 872 (Colonel Platt's *Princess Tonet*), 873 (the Earl of Cawdor's *Rosal 7th*), and 877 (Colonel Platt's heifer). We are of opinion that this breed of cattle will grow in popular favour, owing to their great hardihood of constitution. They are unquestionably adapted for cold climates.

SAML. GOODE.
JOHN CRANE.

Report of the Judges of Red-Polled Cattle.

[Classes 82 to 86.]

The Red Polls were evidently the pick of those exhibited at the local Shows, for there was scarcely a middling animal amongst them, and the reputation of this rising breed was fully maintained.

CLASS 82—*Bulls calved in* 1883, 1884, 1885, *or* 1886—consisted of six good animals, but had neither a Davyson 3rd nor a Falstaff.

CLASS 83. *Bulls calved in* 1887.—As in the preceding Class, we commended all the animals, the FIRST PRIZE youngster (Lord Hastings' *Viceroy*) being of rather exceptional merit.

CLASS 84—*Cows*—was another good Class: the FIRST and SECOND PRIZE animals were especially good.

CLASS 85—*Heifers calved in* 1886—though it contained one of the best animals, was the weakest Class of the breed.

CLASS 86—*Heifers calved in* 1887—was again a good Class, the FIRST PRIZE (Mr. J. J. Colman's *Mar*) being a gay level heifer that promises to grow into a grand cow.

T. BROWN.
SAML. P. NEWBERY.

Report of the Judges of Jersey Cattle.

[Classes 87 to 92.]

To make this report of interest to those who in the future may not, at the time of reference, have a copy of the catalogue available, we have since the close of the Show gone carefully through the skeleton Judging-books, with the Show catalogue, and added the names of the animals, their exhibitors and breeders.

The classes were of unusual excellence, and owing to the large number of exhibits our work was one requiring much time and labour.

CLASS 87 consisted of twenty-eight *Bulls, two years old and upwards.* To adjudicate upon them was an invidious task, and our difficulties were increased by the excellence of the class generally. The FIRST PRIZE was awarded to No. 921, *Chestnut Boy*, exhibited by Mrs. Hopwood of Ketton.

He was a son of the celebrated bull "Nero du Coin," a prize-winner in Jersey as well as in this country. He showed great quality and wonderful colour and richness of skin. The SECOND PRIZE went to a very promising animal, No. 930, *Marius*, bred and exhibited by Lord Londesborough, and the THIRD PRIZE to a beautiful young bull, No. 935, *Franciscan*, bred by Mr. J. S. Arthur in Jersey, and exhibited by Mr. J. R. Corbett, of More Place, Betchworth, which was second in his class at the Royal Counties Show at Bournemouth, and first at the Bath and West of England Meeting at Newport. No. 933, *Frivol*, bred and exhibited by Mr. W. E. Budgett, of Stoke Bishop, was HIGHLY COMMENDED and RESERVE NUMBER. The HIGHLY COMMENDED animals were No. 924, Griffin & Co.'s *Prophet*; 927, Mr. William Alexander's *Sir Richard*; and 929, Mr. Hugh C. Smith's *Duke Martyn* (all bred in Jersey by Mr. William Alexander, of Grasfort, the two first sent direct by island exhibitors, the latter purchased by Mr. Hugh C. Smith last season); No. 940, *Temptation*, bred by Rev. J. C. Plattin in Norfolk, and exhibited by Mr. John E. Groom, of Great Walsingham; and No. 931, *Dog Fox*, bred by Mr. J. Cardus, Southampton, and exhibited by Mr. Brutton, Yeovil, a victor in many a contest, but whose age tells against him. The COMMENDED animals were No. 914, *Ranksborough*, bred and exhibited by Mr. E. H. Baldock, of Melton Mowbray; No. 919, *Khedive's Boy*, bred by Mr. W. Amy, of Jersey, and exhibited by Mr. Thos. Shaw, M.P., of Halifax, Yorkshire; and No. 932, *Gordon*, bred and exhibited by Mr. Joseph Brutton, of Yeovil.

CLASS 88 was for *Yearling Bulls*. The FIRST PRIZE fell to No. 965, *Hamilton*, bred by Mr. J. C. Hamon in Jersey, and exhibited by Mr. Wm. Arkwright, of Sutton Scarsdale, Derbyshire, a bull showing great quality and rich colour. He promises to be an animal likely to acquire distinction, not only in the show-ring but in the herd. The SECOND PRIZE went to No. 942, *Bessie's Boy*, bred and exhibited by Mr. G. Simpson, of Wray Park. He is a finely-grown and consequently for the moment a somewhat unshapely bull. The THIRD PRIZE fell to No. 948, *Hamley*, by Mr. James Blyth's "Wolseley's Glory 2nd," bred and exhibited by Mr. S. Baxendale, of Bonningtons, Herts, a small animal which owed his position among many much more forward competitors to his extraordinary symmetry and quality, a confirmation of his previous performance at the Royal Counties Show at Bournemouth, where he was first. No. 967, *Grouville's Champion*, bred by Mr. W. G. Aubyn, of St. Saviour's, Jersey, and exhibited by Mr. W. D. Tucker, of Southampton, was RESERVE and HIGHLY COMMENDED. This bull had already taken two first prizes on the island as well as the first prize at the Oxfordshire Show at Abingdon, the only place in England where he had previously been exhibited. Many of the animals in this Class were of exceptional quality. The HIGHLY COMMENDED were No. 945, *Lemon Peel*, bred and exhibited by the Hon. C. R. G. W. Bampfylde, a beautiful specimen of a yearling bull and a credit to any breeder in this country; No. 966, *Royal Gem*, bred and exhibited by Capt. Le Brocq, of Jersey; and No. 968, *Jubilee Day*, bred and exhibited by Mr. W. D. Watson, of Knutsford, Cheshire. The COMMENDED were No. 943, *Monopolist*, bred and exhibited by Mr. G. Simpson, showing much of the quality of island animals; No. 952, *Royal Calyph*, bred and exhibited by Mr. John Swan of Lincoln; No. 955, *Leonora's Laddie*, bred and exhibited by Mr. H. J. Cornish, of Sherborne, Dorset, having much of the quality of his celebrated dam; No. 960, *Silver King*, bred and exhibited by Mr. W. Alexander, of Jersey, a rich, deep, and fine-skinned animal; No. 963, *Sunlight*, bred by Mr. W. Alexander, of Jersey, and exhibited by Mr. E. P. Fowler, of Southampton.

CLASS 89. *Cows in Milk or in Calf, calved previously to or in the year* 1884.—Rarely, if ever, has a better class of aged cows been seen. The FIRST

PRIZE went to No. 987, *Black Bess*, bred by Mr. J. Arthur, of Jersey, and exhibited by Mr. W. E. Budgett, of Stoke Bishop, a cow without a particularly taking head and with no special claims to beauty, but with an udder of such shape and size that it was impossible to hesitate as to placing her in the premier position. The SECOND PRIZE went to No. 970, *Bessie*, also bred in Jersey, a well-known winner, and exhibited by Mr. G. Simpson, of Reigate. The THIRD PRIZE was won by No. 971, *Rosy 3rd*, bred by Mr. W. Alexander of Jersey, also exhibited by Mr. G. Simpson. This cow is a daughter of Mr. J. Blyth's famous *Rosy*, and destined to take a high position hereafter. No. 983, *Les Prairies Flandrine*, bred by Mr. P. W. Picot, of Jersey, and exhibited by Lord Londesborough, was HIGHLY COMMENDED and RESERVE NUMBER. This was a beautiful cow, and, but for the paucity of prizes, entitled to a monetary honour. The HIGHLY COMMENDED cows in this Class were No. 972, *Lady Nina*, exhibited by the Hon. C. R. G. W. Bampfylde, of Bretton Park, a lovely specimen of an old Jersey cow; and No. 982, *Precoce 2nd*, bred by Mr. T. Mourant, of Jersey, and exhibited by Lord Londesborough; and the COMMENDED were No. 976, *La Belle Bergère*, bred by Mr. P. G. Le Sauteur, of Jersey, and exhibited by Mr. C. J. H. Tower, of Brentwood; No. 977, *Geranium*, bred by Mr. F. Bircham, of Walton-on-Thames, and exhibited by Mrs. Hopwood, of Ketton, an English Jersey Cattle Society's Gold medal cow; No. 978, *Clotho's Gem*, bred by Mr. F. Roissier, of Jersey, and also exhibited by Mrs. Hopwood; No. 990, *Pretty Maid*, bred by Mr. Firminger, of Jersey, and exhibited by Mr. Wm. Adams, of Tuffley, Gloucestershire.

CLASS 90, for *Cow or Heifer in Milk or in Calf, calved in the year* 1885, was also of exceptional merit. The FIRST PRIZE went to No. 996, *Buttermaker's Daughter*, bred by Mr. Robinson, of Jersey, and exhibited by Mr. J. E. Groom, of Great Walsingham, a beautiful heifer bred in the island; the SECOND PRIZE to No. 1002, *Beauty*, bred by the late Dr. Meadows and exhibited by Mr. Hugh C. Smith, of Mount Clare, which might easily be taken for an imported animal; and the THIRD PRIZE to No. 1000, *Governess*, bred and exhibited by Lord Londesborough. No. 994, *Rozels Fuschia*, bred by Mr. J. Germain, of Jersey, and exhibited by Sir Humphrey de Trafford, was RESERVE NUMBER and HIGHLY COMMENDED. The HIGHLY COMMENDED animals were No. 1003, *Stargazer 4th*, bred and exhibited by Mr. J. R. Corbett; No. 1005, *Scarsdale Rose*, bred by Mr. Robin, of Jersey, and exhibited by Mr. W. Arkwright, of Sutton Scarsdale; No. 1007, *Linda's Belle*, bred by Mr. J. J. Le Gros, of St. Peter's, Jersey, and exhibited by Mr. H. J. Cornish, of Sherborne, Dorset. The COMMENDED cows were No. 999, *Hopbine*, bred and exhibited by the Hon. Mrs. Cecil Howard, of Great Missenden, Bucks, and No. 1008, *Blue Stocking*, bred by Mrs. Hunt, of Stamford, and exhibited by Lord Rosslyn.

CLASS 91, for *Heifers calved in the year* 1886, consisted of forty animals. The FIRST PRIZE was easily won by No. 1036, *Golden Lass 4th*, bred by Mr. J. P. Marett, Jersey, and exhibited by Mr. E. P. Fowler, of Southampton, a heifer rather dark in colour but of great richness and symmetry. The SECOND PRIZE went to No. 1009, *Pandora* 10th, bred and exhibited by Mr. G. Simpson, and the THIRD PRIZE to No. 1026, *Madeira 3rd*, bred by Mr. E. Renouf, of Jersey, and exhibited by Mr. H. J. Cornish. Either of these three animals would be a credit to any herd. There were no less than 11 HIGHLY COMMENDED animals, viz., No. 1013, *Milkmaid 13th*, bred by Mr. G. Simpson and exhibited by the Hon. C. R. G. W. Bampfylde; No. 1015, *Mabel*, bred by Mr. W. Peel, of Rickmansworth, Herts; No. 1017, *Wolseley's Janette*, bred by Mr. James Blyth, of Stanstead, Essex, and exhibited by Mr. Salisbury Baxendale, of Bonningtons, Herts; No. 1022, *Wrangler's Fancy*, bred and exhibited by Mr. G. W. Palmer, of Reading; No. 1028, *Try*

2nd, bred by Mr. Langlois, Jersey, and exhibited by Mr. Cornish, of Thornford, Dorset; No. 1034, *Cicero's Sultan*, bred by Mr. J. P. Marett, of Jersey, and exhibited by Mr. E. P. Fowler, of Southampton (this animal was RESERVE NUMBER); No. 1037, *Improved 4th*, bred by Mr. John Trachy, Jersey, and exhibited by Mr. E. P. Fowler; No. 1039, *Attolia 2nd*, bred by Mr. T. P. Gallechau, of Jersey, and exhibited by Capt. Le Brocq, of Jersey; No. 1041, *Bay Leaf 4th*, bred by Mr. P. Arthur, of Jersey, and exhibited by Capt. Le Brocq, of Jersey; No. 1044, *Ettie*, bred by Mr. T. Biampied, of Jersey, and exhibited by Capt. Le Brocq; No. 1045, *Lady Horace*, bred by Mr. Noel de Gruchy, of Jersey, and exhibited by Mr. W. D. Tucker, of Southampton; No. 1046, *Lady Safety*, bred by Mr. Elias Vardon, of Jersey, and exhibited by Mr. H. D. Tucker. The following were COMMENDED: No. 1010, *Pandora 11th*, bred and exhibited by Mr. G. Simpson, and No. 1032, *Sweet Viola*, bred by Mr. S. H. Hyde, of Sunbury-on-Thames, and exhibited by Mr. Walter Barron, of Sefton Park.

CLASS 92—*Heifer calved in the year* 1887—was again a large class of 43 animals. The FIRST PRIZE went to No. 1070, *Fair Angela*, bred by Mr. F. Le Brocq, Jersey, and exhibited by Mr. H. J. Cornish, of Sherborne, Dorset, a very taking calf. The SECOND PRIZE winner, No. 1050, *Lady Godiva*, bred and exhibited by Mr. G. Simpson, ran the first very close, but she was scarcely of equal quality; and the THIRD PRIZE, No. 1065, *Fancy's Pride*, bred and exhibited by Mr. G. W. Palmer, of Reading, was again rather coarser but a very nice heifer. No. 1093, *Mildred 7th*, bred and exhibited by Mr. J. R. Corbett, was RESERVE NUMBER and HIGHLY COMMENDED. The HIGHLY COMMENDED heifers were No. 1052, *Alice*, bred and exhibited by the Hon. C. R. G. W. Bampfylde; No. 1053, *Her Majesty*, bred by the late Mrs. Malcolm, of Lyndhurst, and exhibited by Miss Margaret Peel, of Rickmansworth; No. 1071, *Nero's Derby 2nd*, bred by Mrs. Lee, of Penshurst, Kent, and exhibited by Mr. H. J. Cornish; No. 1072, *Jubilee Queen*, bred and exhibited by Mr. H. J. Cornish; and No. 1,091, *Lady's Pride*, bred by Mr. M. Pinel, of Jersey, and exhibited by Mr. W. D. Tucker, of Southampton. The COMMENDED were No. 1057, *Barton Rose*, bred and exhibited by Sir H. De Trafford, Bart., of Trafford Park; No. 1073, *Bragga's Daisy*, bred by Mr. Louis L. Vaufre, of Jersey, and exhibited by Mr. H. J. Cornish; No. 1076, *Fame*, bred and exhibited by Mr. H. J. Cornish; No. 1080, *Tiara*, bred and exhibited by the Duke of Portland; No. 1083, *Dog Violet*, bred and exhibited by Mr. W. Barron, of Sefton Park; No. 1088, *Scarsdale Dairymaid*, bred by Mr. W. Alexander, of Jersey, and exhibited by Mr. W. Arkwright, of Sutton Scarsdale; and No. 1090, *Belle of Suffield 3rd*, bred by Mr. A. Goold, of Jersey, and exhibited by Capt. Le Brocq.

In conclusion, we should like to say that milking properties were the main points which influenced our decisions, and that it is for its dairy qualities that the Jersey breed deserves the reputation it is rapidly earning. Considering the very large number of animals exhibited in the various classes, and the prizes which we had to distribute among a few meritorious animals, leaving out many others which approached the selected ones very closely in symmetry and quality, and which by other Judges might have been considered superior, we hope that the Society, at their next meeting at Windsor, the centre of a district in which the breed abounds, will see their way to increase, not only the amount, but the number of prizes.

We may mention that Mr. Hugh C. Smith, of Mount Clare, Roehampton, assisted us in Classes 88, 90, 91, and 92, and that in consequence of a difference of opinion between us in Class 87 (for old bulls), we called in the assistance of the umpire.

WALTER GILBEY.
THOMAS FALLA, Jun.

Summary of Jersey Cattle exhibited.

No. and Class		No. of entries	Home bred	Island bred	Home bred: Prizes	Home bred: Commendations	Island bred: Prizes	Island bred: Commendations
	Bulls							
87	Old bulls . . .	28	12	16	1	1 4	2	4
88	Yearlings . . .	27	19	8	2	5	1	4
	Total Bulls .	55	31	24	3	1 9	3	8
	Cows							
89	Aged	23	5	18		1	3	6
90	3-year-old . . .	16	8	8	2	3	1	3
91	2-year-old . . .	40	19	21	1	6	2	1 7
92	Yearling	44	38	6	2	9	1	4
	Total Cows .	123	70	53	5	19	7	1 20

Report of the Judges of Guernsey Cattle.

[Classes 93 to 97.]

We had 52 of this breed brought before us for adjudication.

In Class 93—*Bulls calved in* 1883 *to* 1886—the animals were of fairly average merit. Nos. 1098 (Mr. H. S. Morris's *Norman*), 1097 (Mr. W. A. Glynn's *Hopeful*), 1103 (Sir Francis Montefiore's *Sir Francis*), and 1096 (Mr. George Long's *Original*) were in our opinion unquestionably the best bulls in the class, and were awarded First, Second, and Third Prizes and Reserve Number in the above order.

In Class 94—*Young Bulls*—there was a good and level lot of young animals, without any one of extraordinary merit. It is worthy of remark that twin-brothers were awarded the first and third places.

Class 95—*Cows or Heifers in Milk*—was by no means a good or typical group of the breed, the First Prize, No. 1119 (Mr. H. S. Morris's *Blossom*), being by far the best, although some persons may take exception to her black nose.

Class 96. *Heifers calved in* 1886.—In this Class the quality and characteristics of the breed were better and more decided than in any of the foregoing. We would mention, however, that though we commended No. 1136 (Mr. W. D. Tucker's *Rosy of Calais*) for her very promising dairy properties, we consider her colour (pale-red and white) is against her as a typical Guernsey.

Class 97—*Heifers calved in* 1887—was an unusually large and promising Class, when we remember that this breed is but little known in the northern counties, though its hardy character and excellent dairy properties only require to be more widely known to increase its popularity.

J. G. S. Nichol.
G. Nevile Wyatt.

Report of the Judge of Dairy Cattle.
[Classes 98 and 99.]

CLASS 98—*Cows of the Shorthorn type*—was well represented, the whole number of cows possessing excellent merits both as dairy cows, also for fattening purposes. I strongly recommended a THIRD PRIZE in this Class,[1] as the whole were an exceptionally good lot.

CLASS 99. *Heifers of any breed or cross under three years old.*—The number forward in this Class was disappointing, but the quality was very good indeed.

I would respectfully suggest that two Judges be appointed in future for these Classes, instead of one.

THOMAS CARRICK.

[For Report on Dairy Cattle Competition in Classes 100 and 101, see page 639].

Sheep.

Report of the Inspectors of Shearing.

We have this morning (July 9) finished our inspection of Sheep-shearing at this Show. We have carefully gone over the very large number of sheep shown, and beg to report, with great satisfaction to ourselves, the continued improvement we find in all Classes. The appearance of some odd lots of the heavy-growing woolled-sheep—at first glance—drew our close attention to more minute examination, which proved to us that the whole of the sheep in the Yard have been shorn to the satisfaction of your Inspectors. We recommend the Council to pass the whole, and to make a clean sheet for 1888.

We did draw attention of some shepherds to some little faults we found, but not to such an extent as to warrant us to recommend disqualification in any one case.

WILLIAM JOBSON.
J. B. WORKMAN.

Report of the Judges of Leicesters (Classes 102 to 105), Cotswolds (Classes 110 to 113), and Lincolns (Classes 114 to 117).

CLASS 102. *Leicester Two-shear Rams.*—We consider the animals exhibited in this Class to be of exceptional merit.

CLASS 105. *Leicester Shearling Ewes.*—All the PRIZE and COMMENDED pens are of very great merit.

CLASS 110. *Cotswold Two-shear Rams.*—All good sheep.

CLASS 111. *Cotswold Shearling Rams.*—A small but good Class, not equal to those entered in the preceding Class (110).

CLASS 112. *Cotswold Ram Lambs.*—Well-grown lambs, and very promising.

CLASS 114. *Lincoln Two-shear Rams.*—A very good Class, the FIRST PRIZE sheep being exceptionally good.

CLASS 115. *Lincoln Shearling Rams.*—A very numerous Class—36 sheep exhibited. The number of commendations (eight) shows our opinion of the high character of the Class. The merits of the prize-winners were very equally balanced, and were well worthy of the large prizes given.

JNO. PERCY CLARK.
W. T. GARNE.
H. MACKINDER.

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[1] This extra prize could not be granted by the Council.—ED.

Report of the Judges of Border Leicester and other Short-woolled Sheep.

[Classes 106 to 109, and 141 to 143.]

The Judges have much pleasure in remarking the great improvement in the whole class of *Border Leicesters*, both in number of entries and quality of sheep.

In CLASSES 141 to 143 the Judges could not come to a satisfactory conclusion, owing to there being so many different varieties of breed, which could not fairly be brought into the same competition.

JOHN DAVISON.
GEO. REA.

Report of the Judges of Oxfordshire Down Sheep.

[Classes 121 to 124.]

CLASS 121. *Two-shear Rams.*—Nothing exhibited calling for special notice.

CLASS 122. *Shearling Rams.*—In a Class numbering twenty-seven entries some excellent specimens of this useful breed of sheep were exhibited—indeed, so good were they, the Judges felt that they could not do less than commend the whole Class, and also recommend that a THIRD PRIZE be given.

CLASS 123. *Ram Lambs.*—On the whole this was a satisfactory class.

CLASS 124. *Shearling Ewes.*—This was an exceptionally good Class, all the exhibits, in addition to the prize pens, being COMMENDED.

The Judges wish to place on record that in their opinion the present exhibition of Oxfordshire Downs is one of the best that has ever been held.

W. D. LITTLE.
NATHANIEL STILGOE.

Report of the Judges of Shropshire Sheep.

[Classes 125 to 128.]

Shropshire sheep-breeders may congratulate themselves upon the fine display the representatives of that breed have made at Nottingham.

CLASS 125—*Two-shear Rams*—comprising twenty-four entries, with few absentees, would be considered a numerous Class. The FIRST PRIZE was awarded to the fine ram (Mr. Joseph Beach's *Royal Jubilee*), the winner in the Shearling Class last year at Newcastle-upon-Tyne. The SECOND PRIZE, No. 1433 (Mr. John Harding's *Lord Cardigan*), is an animal of beautiful quality, even and compact throughout, with good Shropshire character. The THIRD PRIZE, No. 1423 (Mr. F. Bach's ram), is a massive sheep, with fine outline: had he possessed a better head he would have been hard to beat. The FOURTH-PRIZE winner was No. 1431 (Mr. A. S. Gibson's *Bulwell Prince*), a rather small sheep of beautiful quality.

CLASS 126—*Shearling Rams*—comprised ninety-six entries, an immense Class, and, with few exceptions, wonderfully good, and taking the Judges much time to adjudicate the prizes. The FIRST PRIZE fell to No. 1468 (Mr. A. E. Mansell), a ram worthy of the honours conferred upon him, being even and true throughout, and possessing all the attributes of a pure-bred Shropshire. The SECOND PRIZE, No. 1521 (the Executors of the late Sir Robert Loder): big, with good flesh upon short legs, and only beaten for FIRST PRIZE by the excellent quality of the winner in the Class. The THIRD, No. 1480 (Mrs. Barrs), a compact sheep, of nice quality and great scale. The FOURTH, No. 1514 (Mr. Joseph Beach), was a ram also of wonderful quality; rather too

fine in the head and neck. The number of HIGHLY COMMENDED (12) and COMMENDED (15) animals in the Class testified to its general excellence.

CLASS 127—*Ram Lambs*—containing twenty entries, some of which are of great merit. The FIRST PRIZE, No. 1551 (Messrs. T. and S. Bradburne): a pen of great muscular lambs, promising to make good sheep. The SECOND No. 1560 (the Executors of the late Sir Robert Loder): strong, lengthy lambs, likely to make heavy sheep. The THIRD, No. 1554 (Mr. Richard Brown), are upon a smaller scale, with nice quality. The FOURTH, No. 1550 (Messrs. T. and S. Bradburne), were also useful lambs, not very well matched.

CLASS 128—*Five Shearling Ewes*—contained twenty-four entries, which caused the Judges considerable trouble to award the prizes. Seldom has this Class been so numerous and generally good. The FIRST PRIZE, No. 1589 (Mr. P. Albert Muntz, M.P.), are fine specimens of this popular breed, being well matched, with good coats and heads. The SECOND, No. 1586 (Mr. Thomas S. Minton), were very thick, compact, and symmetrical, showing good constitutions, likely to thrive in any climate. The THIRD, No. 1574 (Mr. William F. Inge), were big, roomy ewes of great size and good character. The FOURTH, No. 1592 (Mr. Joseph Pulley), were well-matched, with good heads and short legs.

Several of the highly commended and commended pens in the Shropshire Classes are but little inferior to the prize-takers.

PETER EVERALL.
JOHN EDWD. FARMER.

Report of the Judges of Southdown Sheep.

(Classes 129 to 132.)

Both numerically and in point of merit this breed was well represented there being no less than sixty-eight entries in the four Classes.

CLASS 129. *Two-shear Rams.*—The FIRST PRIZE ram, No. 1610 (Mr. Edwin Ellis), barring his neck, is a remarkably fine, well-formed animal, with a particularly good leg-of-mutton. The SECOND PRIZE, No. 1607 (Mr. J. J. Colman), a smart sheep, and carries his head well. The THIRD PRIZE, No. 1594 (H.R.H. the Prince of Wales), exhibits masculine character, but is a bad walker. Seven others also gained distinction, being either highly commended or commended. Amongst the latter was a ram which would have stood much higher had not nature endowed him with a hairy breech.

CLASS 130. *Shearling Rams.*—There were twenty-seven entries, some of which, for the credit of the breed, would have been better absent. The FIRST PRIZE goes to No. 1634, and the second to No. 1635 (both Mr. J. J. Colman's), two sheep of nearly equal merit. Probably next year these two, if shown, may change places, inasmuch as the FIRST PRIZE animal has already rather a protuberant paunch. The THIRD PRIZE falls to No. 1613 (H.R.H. the Prince of Wales), a strong useful sheep. In addition to these, eight good rams received recognition at our hands.

CLASS 131. *Pens of Three Ram Lambs.*—Judging from the greasiness of their coats, some of the lambs appear to have been housed. We strongly deprecate this premature forcing. We awarded FIRST PRIZE to Pen No. 1640 (Mr. Alfred Heasman). These were sent, we should say, in a natural state, and are well-grown lambs, although apparently older than the rest. In the SECOND PRIZE pen, No. 1647 (the Pagham Harbour Co.), two are good lambs, but the third is an indifferent one. We HIGHLY COMMENDED two more pens.

CLASS 132. *Pens of Five Shearling Ewes.*—These were so uniformly excellent that we had much pleasure in commending the whole Class. The FIRST

PRIZE pen (Duke of Richmond and Gordon), possibly the smallest sheep in the Class, were notwithstanding such perfect specimens of the Southdown type, and altogether of such sweet feminine character, that we could not do otherwise than award them the premier position. The SECOND (Mr. J. J. Colman) and THIRD (Mr. Edwin Ellis) prize pens had not much to choose between them, the whole ten being beautiful ewes.

We desire to express our opinion that on this occasion the females were far away better than the males.

MANFRED BIDDELL.
THOMAS FULCHER.

Report of the Judges of Hampshire, Suffolk, and other Short-woolled Sheep.

[Classes 133 to 136, 137 to 140, 141 to 143.]

CLASS 133. *Hampshire Two-shear Rams.*—The FIRST PRIZE winner (Mr. Henry Lambert): a good heavy sheep, with good wool and quality. The SECOND PRIZE (Messrs. C. and T. Coles): useful, but hardly well enough covered, and not quite good behind. THIRD PRIZE (Mr. Frank R. Moore): a short sheep, not good in wool.

CLASS 134. *Shearling Rams.*—FIRST PRIZE (Mr. Henry Lambert): deep, but has the fault of all the Class in being light in leg. SECOND PRIZE (Mr. Frank R. Moore): long and kind, but might be covered better; good coat. THIRD PRIZE (Mr. Robert Coles's *Young Victor*), a useful sheep, but light in thighs. Reserve (Messrs. C. and T. Coles): best back in the Class; lacks size, and has a bad dock.

CLASS 135. *Ram Lambs.*—Class fairly represented, but in each lot, two out of the pens were far better than the other, which somewhat spoiled the Class.

Class 136. *Shearling Ewes.*—Three first pens very good. First pen (Mr. H. Perry Keene): two ewes, rather dark round the ears, very good bodies. Second pen a trifle short.

CLASS 137. *Suffolk Two-shear Rams.*—A fairly represented Class. No. 1693 was disqualified because, in our opinion, he was suffering from hereditary disease.

CLASS 138. *Shearling Rams.*—FIRST PRIZE winner (Marquis of Bristol's *Van Tromp 5th*), a very nice sheep, with good quality and wool; we think the wool in this Class should be more free from grey.

CLASS 139. *Ram Lambs.*—A good Class. FIRST PRIZE (Marquis of Bristol), will grow into a grand sheep. The best lamb in the Class was in the reserve pen (Earl of Ellesmere.)

CLASS 140. *Shearling Ewes.*—FIRST PRIZE pen (Marquis of Bristol), nice quality, but badly covered. SECOND PRIZE lot (Mr. Joseph Smith), plenty of size, but one had a very bad coat.

FRANCIS P. BROWN.
GEORGE KING.

Wool.

Report of the Judge of Lincolnshire Long Wool.

[Classes 144 and 145.]

I have to report that the whole of the fleeces shown in Classes 144 and 145 were of the true lustre type, very well bred, and well handled.

Of the he-hog wools, lots 1730 (Mr. George Marris) and 1733 (Sir J. H. Thorold, Bart.) were all strong and sound, but the she-hog wools, 1734

(Mr. G. Marris) and 1738 (Mr. John Pears), were somewhat weak, and in some of the fleeces the staple would break about the middle. This is a more serious fault in lustre wool than in any other sort. The wools which won the First and Second Prize in both Classes were very near in point of excellence, and both were wools which left little or nothing to be desired from a wool-trade point of view.

It seems a pity that in the midst of such a good lustre-wool growing district as Nottingham there was not a larger entry for these prizes. Bright wool makes in proportion as good a market price as other sorts, and it is highly desirable to keep up its peculiar qualities and characteristics, although they do not command for the moment the higher proportionate rates current some years ago. I would recommend that in future competitions, where there are two prizes, that one should be given for hog wool and the other for wether, or wether and ewe wool. He-hog and she-hog are to the wool manufacturer meaningless distinctions. There seems to me to be more merit in producing a well-sustained ewe fleece than in producing excellence in wool of the first shearing.

John W. Turner.

Pigs.

Report of the Judges of White Pigs.

[Cla ses 146 to 149, 150 to 153, and 154 to 157.]

LARGE WHITE BREED.

Class 146. *Boars, farrowed in* 1887.—A fair Class; first- and second-prize animals (both Earl of Ellesmere's) are good representatives of the breed.

Class 147. *Boar Pigs, farrowed in* 1888.—The Prize pigs are of ordinary merit.

Class 148. *Breeding Sows.*—A grand Class of breeding sows; the prize animals are of exceptional merit, and the remaining exhibits good.

Class 149. *Breeding Sow Pigs, farrowed in* 1888.—The first- and second-prize pens are good, and show much quality.

MIDDLE WHITE BREED.

Class 150. *Boars, farrowed in* 1887.—With the exception of the Prize animals, this is a moderate Class.

Class 152. *Breeding Sows.*—A good Class; the First Prize sow (Mr. F. A. Walker-Jones' *Lilly*) is a fine specimen of the middle breed; the other prize-winners are smaller, but have considerable merit.

SMALL WHITE BREED.

Class 154. *Boars, farrowed in* 1887.—There are two good boars shown, but the remaining entries are moderate.

Class 155. *Boar Pigs.*—Two entries; the First Prize pigs (Earl of Ellesmere's) are not good specimens of the small white breed.

Class 156. *Breeding Sow Pigs.*—There are some excellent sows shown in this Class; the First and Second Prize winners (both Hon. Mrs. Meynell Ingram's) are especially good.

In consequence of the number of disqualifications in the younger Classes, the competition among white pigs is not so strong as we have seen at former Shows of this Society.

George Mangles.
William Tait.

Report of the Judges of the Berkshire, Black and other Coloured Pigs.

[Classes 158 to 161, 162 to 165, 166 to 169.]

The pigs in the Black and other Classes call for no special remark, excepting the Berkshire Breeding Sows (Class 160), and the Pens of three Small Black Boars (Class 163).

BERKSHIRES.

To take the Classes in rotation, we may say that the *Berkshire Boars, farrowed in* 1887 (Class 158), were a small Class of medium quality, the First Prize going to No. 1817 (Mr. Alfred E. W. Darby's *Terrick Prince*), a long and useful, though rather coarse pig, which had the defect of drooping ears, with one of them partly white. The Second Prize, No. 1815 (Mr. Arthur S. Gibson's *Knight Errant*), was of better Berkshire quality, but small for his age, and rather drooping behind. No. 1816, the Reserve (Mr. J. P. King's *Tankerville*), was a nice style of pig, but light round the throat. No. 1819 (Mr. N. Benjafield's *Fair Trader*) would probably have taken a different place if his age had not been several months under that of his competitors.

There were only four entries in Class 159—*Boar Pigs*—and neither quite satisfactory; an unlevel inferior pig spoilt the appearance of Pen No. 1823 (Mr. Nathaniel Benjafield), which was awarded the First Prize. The Second Prize pen (Mr. Alfred Darby) was also spoilt by one animal with an unsightly head, whilst all three were too light in their gammons, but otherwise were rather taking and of nice quality. We could not allot the Reserve Number, as we considered we must have withheld the Prizes if there had been nothing before the remaining pens.

Class 160—*Breeding Sows*—was really a strong one in sixteen entries; scarcely one would have been marked off as of not sufficient merit if they had been within distance of the prize. Drafted to half their number they were certainly a grand lot, and we had some difficulty in deciding between No. 1834 and No. 1839, the former (Mr. Alfred Darby's *Trafford Maid*) eventually taking First, and No. 1839 (Mr .N. Benjafield's *Blanche*) Second; No. 1830 (Mr. J. P. King's *Lady Dorchester*) standing a very good Third.

In Class 161—*Pens of three Berkshire Sows*—Nos. 1843 (Mr. T. S. Minton) and 1841 (Mr. Alfred Darby) were almost a perfect match, both exceedingly nice quality. Pen No. 1840 (Mr. Arthur S. Gibson) contained much the largest pigs in the class, but they were not even on their backs.

OTHER BLACK BREEDS.

With two of the best entries disqualified, Class 162—*Boars farrowed in* 1887—came before us as a very poor one.

Class 163—*Boar Pigs farrowed in* 1888—showed a decided improvement. There were only three entries; still, as a class, they were unusually matching and perfect, not one in the class that did not stand out as a promising young boar on his own merits. We mention this feature as not of frequent occurrence with nine animals in the same Class.

Both the breeding sows and pens of three sows of this breed (Classes 164 and 165) were very short entries.

TAMWORTH.

This breed is evidently becoming more popular, and, we take it, for this reason: with careful breeding they appear to be gradually losing the dis-

advantage of being hard-feeders. It was the general opinion—and we quite indorse it—that a large proportion of the Tamworths at Nottingham showed a great improvement in this respect.

JOSEPH SMITH.
HEBER HUMFREY.

[For Reports on Poultry Classes see page 644.]

Bee Department.

Report of the Judges of Hives, Honey, and Bee Appliances.

It may be fairly claimed for the Bee Department of the "Royal" Show at Nottingham that it was one of the most attractive and most numerously attended, in the successful meeting of 1888. Judging by the crowded state of the manipulating tent, and the general interest taken in the very large display of bee appliances on view, particularly on the last two days of the show, there can be no doubt that bee-keeping has made a considerable impression on the minds of the agricultural population.

Hitherto farmers have been disposed to look askance at bee-keeping, evidently considering it either so small a matter as to be unworthy of attention, or that the difficulties attendant on success in honey production are too great for them. Besides these, some few farmers, to our own knowledge, have looked upon bees as positively injurious to their crops; arguing that what accrues to the bee-keeper is lost to the farmer, in fact, that the nectar extracted by bees from, say clover bloom, is so much produce stolen from him. It is gratifying, however, to find these prejudices rapidly dying out; the more enlightened intelligence of to-day admits that the last-named grievance has no foundation whatever in fact. Not only so, but farmers are —slowly, it is true, but surely—introducing bee-keeping on their farms as being far more profitable than some other things requiring greater care and attention than the keeping of a few colonies of bees.

We know of nothing that can so readily be added to one branch of dairy-farming, i.e. milk retailing, as honey selling. Among at least a dozen farmers in Lancashire, of whom we have personal knowledge, and who have within the last year or two taken up bee-keeping, one in particular—who runs three milk shandries—assured us that his only difficulty was in getting sections of honey sufficient for his customers. His men are asked "when the honey will be ready," and it is freely purchased as soon as produced; so that the farmer here has what so many lack, viz. a good market for his produce without seeking for it. We were also much interested of late, while passing through the market at Carlisle, where on market days small farm-produce is sold, to see a farmer's wife busy selling sections of honey from her own farm, to the evident envy of her neighbours, who had only eggs, butter, &c., to offer.

In short, the Shows of the British Bee-Keepers' Association have made an impression on the mind of the farmer, which in these times of agricultural depression is beginning to assert itself. There is no one from whom the small farmer especially will so readily take a lesson as from one of his own class, and this is just what he is now doing. So soon as a man makes a few stocks of bees "pay well," his neighbour will take note of the fact; and he needs but to attend a "Royal" Show to see bees handled, and to find bee-keepers ready and willing to give him all the information in their power.

The form in which bee-keeping most commends itself to farmers is not to embark extensively in the business, but to begin by keeping two or three hives as an adjunct to the ordinary farm work, and advance accord-

ingly as he finds it succeeds. This is the wisest course to adopt in all cases.

It must have been a source of extreme regret to the promoters of the Nottingham Meeting that the season of 1888, so far as honey production goes, has been one of the very worst on record; and as the authorities of the Show very properly attach greater importance to the honey display than to the department devoted to bee-appliances, the failure of the honey crop was a great disappointment. It is, therefore, to be hoped the year 1889 will —as according to precedent it should—be an exceptionally good honey year. Bee-keepers will then have an opportunity, of which they will not be slow to avail themselves, for showing their produce.

Notwithstanding the adverse conditions named above, the display was most creditable. Of honey, as might be expected, the quantity was small, but of bee-appliances and objects of interest to bee-keepers generally, there has probably never been so large a collection exhibited at any previous show. The total number of entries nearly reached 300, and included no less than ten collections of hives and appliances, the whole of which were staged. All the leading manufacturers were represented, and every article shown was of the most advanced modern type. In nearly all the classes for appliances the competition was very keen, while many of the articles were so nearly equal in merit that judging was not an easy task.

In concluding our report, we may say that taking the Bee Department as a whole, it was both instructive and educational, and it is certain to bear fruit in the interest of the classes for whom it was intended. The amount of shedding allowed for the Department was greater than usual, but had the whole of the entries been staged—as they certainly would have been, but for the bad season—the space apportioned would have been quite inadequate for the exhibits.

George Raynor
Wm. Broughton Carr.
Walter Martin.

XXXI.—*Report of the Steward of Dairying and Poultry at Nottingham.* By Sir John Thorold, Bart., Syston Park, Grantham.

The period of three years for which, by favour of the Council, I was in 1886 appointed Steward of Dairying, having now expired, it becomes my duty to present a report on this most useful and instructive feature of our Annual Shows; and in doing so, I wish to thank those officials of the Society whose constant assistance has enabled me to carry out the duties of a department in which I take the greatest interest, and which in the past has been, and will in the future still more be, of material assistance to the British farmer.

The Nottingham Working Dairy.

The Working Dairy has been so often and so fully described in past numbers of the Journal, that there is no necessity now to speak of its general scheme and objects in any detail, and it

must suffice to say that each successive year appears to reveal a greater interest by the public in its operations.

The Council having determined to institute a competition of butter-makers in connection with the Nottingham Meeting, it became necessary this year to make considerable alterations in the arrangements. As it was hoped that the entries would be numerous and that the whole of the floor space would be required by the competitors, the articles shown in the Dairy were restricted as much as possible, and all apparatus requiring power to drive it was excluded. The entries were unfortunately few, and by placing the churns used in the demonstration at one end of the dairy, ample space was obtained.

The dairy was roofed with Messrs. Major's patent tiles, which looked well, and were water-tight and cool. But as the dairy faced the north, and everything had been done to provide for the hot weather we have usually had to contend with, it soon became apparent that it was much too airy for the chilly breezes we were to encounter at Wollaton Park. Cream placed in the churns at the usual temperature, and churned on the most approved principles, took an inordinate time to become butter, and fairly puzzled all the professors. It was only by putting up canvas screens and by closing the ventilators, that the dairy was made tolerable to those who had to use it.

The milk, supplied by Messrs. Shardlow & Co. of Derby, was of good quality, and was punctually delivered. Some very good milk was purchased in the yard, and it is worth considering whether in future an attempt should not be made to arrange with the exhibitors to purchase all the milk their cows give during the Show week at a price to be agreed upon beforehand. The extreme simplicity of our engineering arrangements was the cause of some trouble and delay. The pulley of the engine lent by Messrs. Davey, Paxman, & Co. was too large for Messrs. Freeth & Pocock's Victoria Separator, and a smaller pulley had to be procured and fitted. It was only by the hearty co-operation of all concerned that the cream was separated by 9 o'clock on Thursday night; after this the engine (which really had no work to do) ran as smoothly as possible, while supplying ample steam for heating purposes, and the Separator did its work in a most efficient manner. A small dairy was provided at the side for exhibiting the Jersey and Dorset Creamers, to the former of which the Judges of Miscellaneous Implements awarded a Silver Medal.[1]

[1] The report of the Judges on these Creamers is included in the General Report on the Miscellaneous Implements at Nottingham, the publication of which is necessarily postponed until the next number of the Journal.—Ed.

As usual, we had some difficulty in disposing of our skim milk during the commencement of the Show, but charitable persons in the town undertook to distribute it, and we were informed that it was greatly appreciated. Later in the week the demand for skim milk, for butter, and for the small French cream cheeses greatly exceeded our supply.

Miss Smithard lectured to a very large and attentive audience during the week, explaining the Normandy and Danish systems of butter-making. She also made the French cream cheeses, which seemed to be extremely popular at Nottingham, and would be found to be much more profitable than butter during the summer months.

Advantage was taken of the crowds which daily thronged the stand to make a free distribution of some very plain and practical Rules for Butter-making, which had been kindly drawn up for the Dairy Committee of the Society by its chairman (the Hon. Cecil Parker), and which have since been issued with the authority of the Committee on a printed sheet adapted for hanging up in dairies.[1] These Rules indicate so well the essentials of proper butter-making, that I do not hesitate to reproduce them below:—

Simple Rules for Butter-Making.

Wash, in cold water, all dairy utensils to be used, such as churn, butter worker, wooden butter hands, &c.

Now scald with hot water, wash again with cold.

Always use a thermometer.

The churn and cream to be at a temperature of 56° to 58° in summer, and 60° in winter.

Ventilate the churn freely and frequently during churning, until no air rushes out when vent-peg is taken out.

Churn at 40 to 45 revolutions per minute.

Stop churning immediately the butter comes. This can be ascertained by the sound; if in doubt, look.

The butter should now be like grains of mustard seed.

Draw off the butter-milk, using a piece of straining cloth—so as to prevent the loss of any butter—and wash the butter in the churn with plenty of cold water. Turn the churn two or three times very gently, then draw off the water, and repeat the process until the water drawn off is quite clear and free from butter-milk.

Make a strong brine and pour into churn through a hair sieve. Wash the butter thoroughly and draw off brine; take the butter out of the churn and put it on the butter worker, which use until every drop of butter-milk is pressed out of the butter.

N.B. Never touch the butter with your hands.

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[1] Copies of this sheet can be obtained at the offices of the Society at 1*d.* each or 5*s.* per 100.

THE BUTTER-MAKING COMPETITION.

Mention has been made above of the competition of butter-makers which had been arranged by the Council to take place during the Show, and which it was hoped would attract a large number of candidates for the prizes offered. This was the first actual competition that has been held under the auspices of the Society, though in each of the three preceding years a "practical examination" of dairy-workers had been held in connection with the country meeting, though before the actual Show days. Perhaps I may be permitted, before speaking of this year's competition, briefly to summarise the previous action taken by the Society to encourage the proficiency of dairy workers, since this happens to be the one feature of the Dairy Department that has yet received no formal notice in the pages of the Journal.

In the report to the General Meeting of Members held on December 11, 1884, it was announced that the Council had decided to apply a portion of the Educational Grant to the practical testing by an examiner of the skill of cheese and butter-workers, in the hope, as expressed in the next report of the Council, that "a scheme of practical examinations may tend to the benefit of the dairy workers who obtain the Society's certificate of efficiency, and at the same time lessen the difficulty which dairy farmers find in obtaining competent persons to make butter and cheese."

The examination took place in the Working Dairy at Preston in July, 1885, during the week preceding the Show. For the certificate of proficiency in cheese-making, no dairy-women, and only two young dairymen, competed. The examiners reserved their awards until after the cheese made had become fully ripe; and eventually reported that they did not feel justified in recommending the grant of a certificate to either competitor.[1] For the Butter-making Certificate there were five competitors, and the Examiners awarded the first prize of 5*l.* to a dairymaid, the second prize of 3*l.* to a lad of fifteen, and the third prize of 2*l.* to a dairyman, commending another (female) competitor.

At the Norwich Show in 1886, prizes and certificates were offered for both Cheese and Butter Workers, subject, as regards the former, to the entry of six candidates. As sufficient competitors did not present themselves, there was no examination of cheese-workers. But, as regards butter-workers, there

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[1] The full Report of the Judges will be found on pp. 333-36 of the Journal for April 1886—Vol. XXII., Part I.

were three competitors, and certificates of efficiency were awarded to all of them, the first two prizes going to men, and the third to a dairymaid.

At Newcastle (1887) there were four competitors. The first (5*l.*) and the third (2*l.*) prizes were won by dairymaids, and another dairymaid was commended; while the second (3*l.*) prize was awarded to a lad.

In connection with the Nottingham Meeting, the Council determined, in December 1887, that there should be a competition of Butter-Makers during the Show week in three distinct classes, viz. members of a farmer's family, male hired servants, and female hired servants; champion silver and bronze medals being offered for subsequent competition by the prize-winners in each class. The following were the principal regulations of the competition as finally settled:—

The Competitors will be divided into the following classes:—

Class 1. (*Tuesday*). Members of a farmer's family.
Class 2. (*Wednesday*). Male hired servants.
Class 3. (*Wednesday*). Female hired servants.
Class 4. (*Thursday*). Champion—limited to the winners of prizes in the three preceding classes.

The following prizes will be given in each class in the event of the Judges considering that sufficient merit has been shown by the competitors:—

First Prize . 5*l.* Second Prize . 3*l.* Third Prize . 2*l.*

The Society's Silver Medal will be given to the competitor who is adjudged first in the Champion Class, and the Society's Bronze Medal to the competitors placed second and third.

The Society's Certificate of efficiency will also be given to the competitors who win money prizes.

With the exception of churn makers, vendors, or their assistants, these prizes are open to general competition.

Eight quarts of cream will be provided for each competitor, and the butter made will be the property of the Society. Competitors must bring their own churns and butter boards, but the Society will provide tables scales, and pails.

[The railway companies have consented to allow competitors who may travel to the Show-yard by rail, to take their churns with them free of charge, as passenger's luggage.]

The number of competitors who entered themselves was as follows: Class I., 8 members of a farmer's family; Class II., 3 male hired servants; Class III., 3 female hired servants.

It is greatly to be regretted that these entries were so small, but the deep interest shown by the spectators should encourage the Society to offer the same prizes another year, and to ascertain if it is possible in any way to reduce the expense to which the competitors are now put. It was perhaps fortunate for the officials of the dairy that the competitors were not more numerous, especially as the time occupied in churning was

much longer than usual, as an opportunity was thus afforded of seeing the difficulties that would arise in the management of a larger entry. As Mr. H. Hildyard, the assistant steward of the dairy, had had previous experience in the conduct of similar competitions, I asked him to undertake the management of this competition, which he carried out to the entire satisfaction of those concerned. The thanks of the Council are due to Mr. Carrick, who as sole Judge had a difficult and responsible task to perform. I append his report, with the addition of the names of the successful competitors.

Report of the Judge in the Butter-Making Competition.

CLASS 1.—This class brought forward eight competitors, viz., 7 women and 1 man. Each competitor was supplied with 8 quarts of cream at a temperature of 58°. All commenced churning at the same time, in churns of various makes chosen by the competitors. The first prize was awarded to No. 3 [*Mrs. Matilda Holmes*, of Home Farm, Leigh, Tunbridge, Kent], who produced 5 lbs. 6 oz. of very good butter in sixty-four minutes. No. 8 [*Mrs. Stevenson*, of Rossburn House, Shincliffe, Durham] obtained the second prize, and No. 1 [*Miss Amy Barron*, of Borrowfield House, Borrowash, Derbyshire] third prize. The whole of the competitors did their work in a most creditable manner.

CLASS 2 only brought forward three competitors. The first prize was awarded to No. 9 [*James Walker*, Portmahon Farm, Everton, Sandy, Beds], who produced 5 lbs. 5 oz. of butter in seventy-two minutes; the butter was fair quality and made in good style. No. 10 [*Thomas Smith*, of Barrowmore Farm, Chester] was awarded the second prize, and No. 11 [*Thomas Kew*, 15 Market Place, Leicester] third.

CLASS 3.—Here again there were three competitors. The first prize was awarded to No. 14 [*Miss Frances M. Walshe*, of Wood House, Aldford, Chester], who produced 5 lbs. 4 oz. of butter in seventy minutes. No. 13 [*Mrs. Walker*, of Portmahon Farm, Everton, Sandy, Beds] was second, and No. 12 [*Miss Alice Aldridge*, of 9 Market Place South, Leicester] third.

The quality of the butter made in this class was moderate.

CHAMPION CLASS.—Nine persons competed in this class, 5 women and 4 men. The first prize—a Silver Medal—was awarded to No. 3 [*Mrs. Matilda Holmes*], who produced 4 lbs. 15 oz. of butter in 2 hours and 13 minutes; the second and third prizes—Bronze Medals—to No. 13 [*Mrs. Walker*] and No. 9 [*James Walker*] respectively.

The butter made in this class was poor in quality and took a long time in churning owing to the temperature of cream being low.

The whole of the arrangements for carrying out the various competitions were perfect, and the courteous and assiduous attention of the Stewards of the Department made the duty of judging comparatively light.

THOMAS CARRICK.

DAIRY CATTLE.

The competition of Dairy Cows was carried out under the immediate direction of Mr. Wakefield, the Steward of Cattle, but as the results are of particular interest to the dairy, I hope I

shall not be accused of trespassing when I include them in this report.

The competition had failed in previous years to give satisfaction. At Preston and Norwich the prizes were offered for cows giving not less than 18 quarts and 12 quarts of milk respectively per diem, to contain not less than 12 per cent. of solids (butter-fat), with the result that at Norwich the Judges reported that "either the conditions are too stringent, or the cows exhibited were deficient in milking qualities." These conditions were omitted at Newcastle, where the Judges reported as follows:

"They were instructed to base their awards upon the relative *apparent* milking properties of the animals exhibited, there being no provision made for testing accurately either the quantity or quality of the milk produced. This the Judges much regretted. They would have been better satisfied, and so most likely would some of the exhibitors have been, if the milk had been weighed and the quality carefully ascertained, as was done at Preston in 1885, and at Norwich last year."

Upon this report the chairman of the Dairy Committee, the Honourable Cecil Parker, took counsel with Dr. Vieth, who has had exceptional opportunities for testing both the quantity and quality of milk yielded by various breeds of cattle, and it was decided to recommend the Council to offer prizes, based upon the idea that the animal giving the largest amount of butter-fat in proportion to its live weight was the most profitable animal to keep. In addition, therefore, to the prizes offered by the Local Committee for classes of two cows of the Shorthorn type and of two heifers under three years old, to be judged as at Newcastle by their apparent milking qualities, there were in the Nottingham Prize sheet the two following new classes, in each of which a first prize of 20*l*. and a second prize of 10*l*. was offered:—

Class 100.—One cow, in-milk, of any breed or cross, over 1,200 lbs. live weight, and giving not less than 40 lbs. (about 4 impl. galls.) of milk daily.

Class 101.—One cow, in-milk, of any breed or cross, under 1,200 lbs. live weight, and giving not less than 25 lbs. (about 2½ impl. galls.) of milk daily.

The Regulations affecting these classes ran as follows:—

46. The Cows entered for competition in Classes 100 and 101 will be milked dry on Sunday evening, July 8, 1888, in the presence of the Steward, or a representative of the Society duly authorised by him.

47. They will be milked by the servants in charge of them, at hours to be fixed by the Steward, on the morning and afternoon of the Monday and Tuesday of the Show. Any animal which does not at the four milkings yield an average of at least 40 lbs. weight of milk (about 4 gallons imperial) per day for cows entered in Class 100, and at least 25 lbs. weight (about 2½ gallons imperial) for cows entered in Class 101, will be disqualified.

48. The milk yielded by each cow will be weighed after each milking,

and samples taken for the purpose of ascertaining the percentage amount of butter-fat contained therein.

49. The cows will be weighed on Monday morning, July 9, 1888, after being milked, and again before the last milking on the next day (Tuesday). The mean between these two weights will be held to be the weight of the animal for the purposes of the competition.

50. The Prizes in these Classes will be awarded on the certificate of the Steward [of Cattle], and will be given to those animals which, in proportion to their weight, yield the largest amount of butter-fat in their milk.

Dr. Voelcker, ably assisted by Mr. Arthur Beck, the assistant Steward of Cattle, superintended the milking of the cows, weighed the milk, and took samples, which he analysed in a room reserved for him in the Working Dairy.

The awards were made upon his report by Mr. Wakefield, the Steward of Cattle, on Thursday, July 12.

Taking into consideration the fact that the conditions were new, and not very well understood, the classes filled remarkably well, and though another year improvements may be made in the regulations with regard to the weights of the animals and the minimum yield of milk, yet on the whole we can claim the classes to have been successful, and to have afforded some useful information, which may be gathered from the following report of Dr. Voelcker.

Report of the Consulting Chemist on the Analyses of Milk from the Cows competing in Classes 100 *and* 101.

In obedience to the instructions of the Council, I attended with my assistant in the Nottingham Show-yard, in order to carry out the analyses of the samples of milk yielded by the dairy cows entered for competition in Classes 100 and 101. A temporary laboratory had been erected for my use at the back of the Working Dairy; and the samples when drawn were taken there immediately and subjected to analysis.

Soxhlet's Areometric Method was employed, as being the most suitable one for the estimation of butter-fat under such circumstances as existed. The method was found to work satisfactorily on the whole, though a sudden frost and consequent lowering of temperature during one night caused some inconvenience. The chief difficulty experienced arose, however, from the fact of there being no provision made in Soxhlet's tables for milks of such rich quality as some which had to be dealt with here, the tables not being carried on further than for milks with 5·12 per cent. of butter-fat. This is a manifest defect, and the tables require to be carried out for richer milks. Dilution of some of the richer milks with water had accordingly to be resorted to, but investigation is necessary to see to what extent dilution affects the accuracy of the tabular results.[1]

The cows arrived in the Show-yard on Saturday July 7, and were all milked dry on the evening of July 8. Experience having shown that results obtained from a single milking may frequently prove fallacious from several

[1] Subsequently to the date of the analyses, Dr. Vieth suggested to me that dilution with skim milk of known composition might be more satisfactory. Dilution of the separated ethereal fat solution with ether gave, I found, discordant results.—J. A. V.

external causes, such as the animals not having thoroughly settled down after journeying, the trial was extended over four milkings, viz., on the morning and evening of the following Monday and Tuesday, the hours being 8 A.M. and 5 P.M. Similarly, the live weights were taken on the mean of the weights obtained before milking on the one day, and after milking on the other. The milk was weighed at each time of milking, and samples were drawn by myself. The weighing machines used were obligingly lent to the Society by Messrs. W. & T. Avery of Birmingham.

In Class 100, nine cows were entered; of these, one (No. 1180) did not put in an appearance; one (No. 1172) was not milked on one occasion owing to the absence of the man in charge; another (No. 1174) was disqualified as being under weight, and in the case of a fourth (No. 1175) the milk smelt so badly, owing to the cow being unwell and having been physicked, that it was not included in the full trial. This left practically five to compete for the prizes, and nearly all of these were cross-bred cows.

A perusal of the Table on page 641, giving the detailed results obtained from each cow in this class, will show that all the cows gave more milk on the second day than on the first, with the exception of No. 1176, which fell off very much on the second day; and that the morning quantity was much more than that of the evening on both days, which would be accounted for by the longer interval between the two milkings. On the other hand, the morning milk was the poorer, the quality being especially low on the first morning and improving on the second. The greatest quantities were yielded by No. 1177 and No. 1179, but the quality of the milk of the latter was poor. Calculating the total amount in lbs. of butter-fat obtained in the four milkings, No. 1177 gave the highest result, then No. 1178; but on going into the figures, taking both on the basis of an animal weighing 1,200 lbs., these two came out identical, and but very little ahead of No. 1176, a smaller cow than either. Equal prizes accordingly were awarded to No. 1177, the heaviest cow of all, a big cross-bred with a very large udder, but by no means a shapely animal, and to No. 1178, a neat Shorthorn, and a capital type of a dairy cow. It will be noticed that the cross-bred gave on an average 63 lbs. of milk per diem, and the Shorthorn 56 lbs. To those interested in analytical matters it may be mentioned that, owing no doubt to the physic, the butter-fat would not separate out from the milk of No. 1175 by means of the ethereal solution of potash used in the method of analysis employed (Soxhlet's Areometric Method).

In the second class (Class 101), restricted to cows under 1,200 lbs. live weight, there were 11 entries, of which 10 appeared for competition; three of these were Jerseys, two Guernseys, one Ayrshire, one Red-polled, and the others cross-breds. All came within the conditions as regards weight and yield of milk. It will be noted from the table that one cow only (No. 1183) fell off in live weight. There was but little difference between the yields of milk on the first and second days, and, as in other cases so here, the evening's milk was less in quantity than the morning's, but much richer. The greatest weight of milk, viz. 64½ lbs. per diem, was obtained from the cross-bred cow, 1188; the next, 47 lbs., from No. 1192 (Jersey).

The Jerseys gave more and richer milk than the Guernseys, and it was extremely rich in quality. The Ayrshire cow, No. 1184, gave nothing like the Jerseys either in quantity or quality, while the Red-polled, though superior to the Ayrshire, was in both respects below the Jersey. Making calculations as before, No. 1192 (Jersey) stood easily first, and another Jersey, No. 1183, second. The very regular yields of these two cows are specially to be noted, the daily averages being excellent and the milk exceedingly rich. The other Jersey cow, No. 1189, came third, and then the cross-bred cow, No. 1188.

TABLE SHOWING DETAILED RESULTS OF ANALYSES OF MILK FROM EACH COW.

No. in Catalogue	Name of Exhibitor	Breed of Cow	Live weight of Cow: Monday morning	Live weight of Cow: Tuesday evening	Live weight of Cow: Mean weight	Yield of Milk: Monday A.M.	Yield of Milk: Monday P.M.	Yield of Milk: Tuesday A.M.	Yield of Milk: Tuesday P.M.	Percentage of Butter-fat: Monday A.M.	Percentage of Butter-fat: Monday P.M.	Percentage of Butter-fat: Tuesday A.M.	Percentage of Butter-fat: Tuesday P.M.	Total Butter-fat in four milkings	Butter-fat calculated for animal weighing 1200 lbs.	Awards
	CLASS 100 (*Cows over* 1200 *lbs.*)		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	per cent.	per cent.	per cent.	per cent.	lbs.	lbs.	
1172	Arthur E. Ward . .	Cross-bred	1387¼	1366	1376	21	not milked	25¾	18¼	2·79	not milked	2·73	1·18	—	—	Disqualified, man late for milking Mon. even.
1173	John J. Sharp . .	Not stated	1114	1461¾	1438	33	20¼	37¾	21½	2·71	4·24	2·92	4·73	3 93	3·28	—
1174	Joseph Hanson . .	Cross-bred	1176	1197	1186	29	12¾	28	19	3·22	4·18	4·48	5·12	—		Disqualified, being under weight.
1175	John Goodrick . .	Cross-bred	1570	1574¼	1572	32½	21¾	[1]30	19	4·18	5·04	—	—	—	—	Milk bad.
1176	John Goodrick . .	Cross-bred	1232	1270¼	1251	34½	19¾	26	19	2·93	4·00	4·07	3·98	3·61	3·46	—
1177	Wm. Arkwright . .	Cross-bred	1602¾	1603½	1603	35¾	26¾	37½	26	2·51	4·95	3·46	4·71	4·72	3·53	Equal prizes.
1178	George Sampson . .	Shorthorn	1336	1362	1349	32¼	22	31	23¾	2·76	4·01	3·48	4·26	3·97	3·53	
1179	Lord Egerton of Tttn.	Not stated	1395¾	1454¾	1425	33½	26	36½	27½	1·94	4·59	2·11	3·39	3·54	2 98	—
	CLASS 101 (*Cows under* 1200 *lbs.*)															
1183	Edward Carter . .	Jersey	833¾	823	828	22¾	14¼	21½	14½	4·52	6·50	4·55	6·04	3·81	5·52	2nd prize
1184	Duke of Portland .	Ayrshire	1060¼	1097½	1079	20½	12¾	18½	13	2·98	4·61	3·63	4·11	2·40	2·67	—
1185	George Gooderham .	Red-polled	1021½	1064	1043	25¾	15¾	27	17½	3·22	4·48	3·45	4·85	3·31	3·80	—
1186	John J. Sharp . .	Not stated	1187¼	1199	1193	19	14¼	17½	14	2·60	4·14	2·15	4·48	2·14	2·15	—
1187	John Goodrick . .	Cross-bred	1042½	1052½	1047	24	19¾	27¼	17	1·92	4·59	3·06	4·69	3·00	3·44	—
1188	Wm. Arkwright . .	Cross-bred	1158½	1175¾	1167	39	27¼	37¼	25½	1·95	3·84	2·42	4·85	3·95	4·06	—
1189	Wm. Adams . . .	Jersey	880½	903	892	26½	17¾	24	17	3·38	5·60	3·53	6·02	3·75	5·04	—
1190	Wm. D. Tucker . .	Guernsey	941	937½	939	14¾	14	18	12¼	1·97	5·60	3·64	5·66	2·41	3·08	—
1191	Wm. A. Glynn . .	Guernsey	794½	857¼	826	22½	17½	23¾	16½	2·24	4·98	2·04	3·28	2·39	3·47	—
1192	William Davis . .	Jersey	894¼	943½	919	29	18	29	18	4·64	6 76	4·26	5·77	4·85	6·33	1st prize

[1] Milk smelt badly (cow physicked).

(Signed) J. AUGUSTUS VOELCKER.

Comparing the two classes, it will be seen that the figures of the second class stand relatively higher, and that the cross-bred in this division shows a higher result of butter-fat for its size than the prize-winners in the other class. This gives additional evidence to the great value of Jerseys as butter producers.

No. 1192 and No. 1183 were both beautiful animals; the former, which was only four years old, had a considerable advantage over its older rival, now in her ninth year. Taking this into account, the record of the latter, a well known animal ("Frieda") is a splendid one. I was informed too that she had not been quite well since her journey to the Show, and her yield of milk, which was generally 44 lbs. a day, had fallen off by about 7 lbs. The first prize winner, "Daisy" (No. 1192), has had two calves, and was stated to give at home 45 lbs. of milk daily, never going dry, whilst from four milkings 4½ lbs. of butter are reckoned to be obtained. The figures both of quantity and butter-yield agree, it will be seen, very closely with the weights I obtained and with the results of my analyses on the Nottingham Show Ground. Incidentally it may be mentioned that decorticated cotton cake (broken fine) was the food given to this cow, together with bran and crushed oats. No. 1183 was also fed with decorticated cotton-cake and other foods.

J. AUGUSTUS VOELCKER.

BUTTER.

The entries of butter were 158, and in the opinion of Mr. Hudson—whose report I append—they were unusually good.

Report of the Judge of Butter.

The show of fresh butter in Classes 180, 181, and 182 was exceedingly uniform, and of first-rate quality. I have not seen so many fine exhibits of butter at one time for many years past. The weather being so very cold, in my opinion added considerably to this fact. Class 183 of salted butter, with the exception of the first and second prizes, was not a good class; most of the exhibits had an old and strong flavour from over-keeping. Butter kept beyond a fortnight should be hermetically sealed.

JAS. HUDSON.

Last year at Newcastle no condition was imposed to test the keeping qualities of the salted butter. This year it was sent in a month before the commencement of the Show, and kept in a very cool cellar at Wollaton Hall. It is disappointing to find so little improvement has been made in the art of potting butter. Following up Mr. Hudson's suggestion, it might be well to offer a prize for the best hermetically sealed vessel which did not require the use of solder, and which would not taint the butter. I would suggest that the fresh butter should be sent to the Show in pound pats or rolls, wrapped in butter paper or muslin, and that ice, cabbage leaves, flowers, and other extraneous articles, should be prohibited. The Society now provides cases covered with glass for the butter, so that it might well be sent in on Saturday and judged with the other exhibits on the Monday morning.

Cheese.

There were 115 entries of cheese; the hard cheeses made a very fine show, but the soft cheeses were disappointing. There was no exhibition of the Colwick cheese, a locally made soft cheese something like the French Brie cheese, which is highly popular in Nottingham and must be very profitable to the makers. I had the good fortune to obtain half of one of the First Prize Stiltons which had been presented by the maker to Lady Middleton, and could not resist sending a portion to the Society's laboratory in the hope that Dr. Voelcker might be able to throw some light upon the cause of its excellence. He found it to contain 46 per cent. of fat, and to be richer than the best cheese the late Dr. Voelcker analysed and reported upon in his able article on Cheese in Part I. of Vol. XXII. of the First Series of the Journal. As Mr. Jubal Webb points out in the report which I append, if this class of cheese were more common, we should hear less of the watery and strong-flavoured Gorgonzola now flooding our markets. The successful makers of Stiltons were well rewarded at the Nottingham Show, Mr. Morris, of Manor Farm, Saxelby, Melton Mowbray, taking First and Second Prize in the class of Stiltons made in 1887, and Second Prize in the class for any British cheese made in 1888. It appears to be desirable to restrict exhibitors of cheese to one lot of three or more cheeses in each class, and that a special class should be instituted to encourage early ripened Stiltons made in the year of the Show.

I have to express my regret that well-founded complaints were made by some of the exhibitors of butter and cheese, that their exhibits or the cloths belonging to them were lost. Great care was taken to return everything, but in consequence of some of the exhibits being sold to the agents recommended by the local committee, and of some of the articles being removed by the exhibitors themselves, there was not, on this occasion, that regularity which was desirable.

Report of the Judge of Cheese.

In reporting on the cheese at the Nottingham Show, it is very gratifying to be able to state that it was both comprehensive in the varieties shown, and satisfactory as regards the general standard of quality that prevailed. The lateness and the coldness of the season prevented the cheese being so well developed in flavour and ripeness as would otherwise have been the case, but notwithstanding this drawback the exhibits were such as to deserve high commendation.

Though the *Cheddar* cheese held and maintained a well earned and justly deserved reputation, and the *Cheshire* strove hard to follow suit, successful attempts at early ripening being especially noticeable amongst them, yet

the palm for excellence must certainly here be awarded to *Stilton* cheese. There was a large entry in this class, and with only one exception all of a very high order of merit indeed; in fact, seldom if ever have finer specimens of this cheese—a speciality of English make—been submitted for the inspection of the British public. Rich, ripe, mellow, clean, are terms that accurately describe their merits. A soft silky rich curd that is so often alluded to as a matter of memory, but seldom as a reference to recent experience, was there; and the question arises—was not this a result of the awakening from the lethargy which claimed that a cheese made in the *shape* of a Stilton was a valuable commercial article, without regard to quality or its having to do battle with the foreign product? I think it was, and I can say with certainty that if our English farmers will as a rule—not as an exception—place the high standard attained at the Royal Agricultural Show at Nottingham before them and strive to equal or surpass it, we shall see Stilton cheese rehabilitated in public favour, a pride and a glory of the dairy interest in England, and a winning competitor with that foreign product that has largely worked its way into public esteem, viz. Gorgonzola cheese, simply through the opportunities afforded it by the indifference of the producer to the quality of the product he turned out, and which he called Stilton cheese—however badly made—so long as it was in the shape of a Stilton.

Due attention must be given to these matters by our friends the farmers, as they have to face formidable rivals who have been allowed to obtain a firm footing here; who in a trade of only a few years' growth send in at present forty tons per week; and who are now, as a sequence of the demand, sending a somewhat inferior article to that which gained them their laurels. Here then is the opportunity for British resource and energy to display itself, reassert its ascendency, and recover its market.

The *Cream Cheese* exhibits were few in number, their merits as a class being also somewhat circumscribed. JUBAL WEBB.

POULTRY.

The Poultry Show having failed to fulfil the expectations of its founders, the propriety of its continuance, at any rate in its present form, is now receiving the consideration of the Council. As I did not feel competent to offer any suggestions as to the future management of this department, I asked the Judges to favour the Society in their reports with any suggestions for the improvement of the prize list that would tend to make the Show more popular with the exhibitors, and more practically useful to the breeders of farm poultry.

Report of the Judge of Heavy Poultry.

The heavy poultry were a creditable lot, and some of the classes were well represented. Perhaps the quality throughout has not been equalled at any previous exhibition of the Society. It is also satisfactory to notice that most of the prizes were won by birds belonging to farmers who have taken up the hobby of rearing and exhibiting poultry. This is as it should be, and in fact the original idea of the Council. It is quite out of the question to ever expect farmers and others who breed commercial poultry only, to exhibit successfully at any exhibition in the kingdom, in competition with the

"fancier," any more than the farmer who breeds ordinary horses, cattle, sheep, &c., has, in exhibiting in our Agricultural Show Yards in competition with enthusiastic admirers. But these commercial breeders are glad to avail themselves of the opportunity of attending important exhibitions of stock, where they can choose a variety and select a strain from which they can procure animals to improve their stock at home. There is no doubt that hundreds of farmers have seen the prize poultry exhibited at the "Royal" of recent years who would never think of entering a Fancier's Show pure and simple, and I have little doubt that many such have been influenced thereby to study their own interests in looking more particularly after the welfare of their poultry at home.

I think it most essential that poultry should be one of the branches represented by the Royal Society. The benefit to the country may be gradual and unseen for a time, but ultimately I feel convinced it will stimulate farmers—more than any other Show can do—to take a greater interest in domestic poultry.

The improvement and cultivation of all well-bred stock will be sure and permanent if the example and copy-head is shown to go by. I am greatly in favour of pure-bred animals and poultry. In all their various strains I would strongly advocate and encourage their purity. One or two classes of non-pedigreed animals in each department is ample crossing to encourage. In the poultry exhibition, a class for Table Poultry is all the crossing that should receive countenance from headquarters.

I feel convinced that if the Poultry department of the Royal Show was more economically managed and better arranged, it would become one of the most interesting and successful exhibitions of the year. I have no doubt that Messrs. Spratt could have comfortably arranged five or six hundred pens of poultry in the shed of this year, in quite as favourable a position for Judges and visitors as the present management, where 350 pens occupy the entire space.

Other improvements in the right direction would be to extend the classification, to divide the sexes, and make the classes for single birds. Another point of the first importance is to arrange the whole of each class on the same line or level: whether it be on the top or bottom tier of pens is immaterial, so long as each class is at the same elevation.

I strongly approve of keeping the names of the Judges a profound secret. There is much more to be said in favour of the Council's established rule in this particular than against it. That practical Judges are always elected is sufficient for exhibitors to depend on and know.

Brahmas and *Cochins* were fairly represented at the Show. They are useful varieties to encourage, they add size and frame to commercial poultry, and produce good winter layers.

Dorkings, our popular English table fowl, were large classes, which contained some of the best specimens of the breed.

The good qualities of the *Langshans* are being appreciated by the country; they were represented here by 27 pens, mostly uniform and typical birds. They are large, long-breasted, fleshy table birds, and combine good laying properties. They deserve all the patronage accorded them.

Plymouth Rocks, as here, generally muster well at all Shows. They are now well established, and are essentially a commercial fowl, very hardy, mature early, useful table birds, and good layers. In all, 24 pens were exhibited, the chickens being specially good.

Scotch Greys do not muster well out of Scotland, but they are certainly deserving of encouragement and cultivation. They are suited for any climate, are handsome and graceful fowls, with good table and laying qualifications. The prizes in this class all went to birds direct from Scotland.

Any other Variety Classes, for adults and chickens, consisted of Polands, Malays, Indian Game, Spanish, La Fleche, Redcaps, Wyandottes, &c., most of which possess such good all-round commercial qualifications that they should in future be favoured by this Society with separate classes.

Respecting the *Ducks, Geese*, and *Turkeys*, which were judged together by Mr. Cresswell and myself, it is only necessary to say that the *Waterfowl* were small classes, accounted for by the adult birds being in their worst plumage at this present season. The specimens, however, were very fine, and the youngsters very forward and well grown.

The Black or Bronze Turkeys, cock and hen, brought forward a good and attractive class, the winning birds being magnificent.

D. Bragg.

Report of the Judge of Light Poultry.

Taking the classes of Light Poultry as a whole, I do not consider them so well filled as might be expected at a Show of such importance as that of the Royal Agricultural Society, and when the prize list is on so liberal a scale.

Houdans, the most hardy and generally useful of the French breeds, came first; the prize birds in the adult class were all fine specimens, the chickens were throughout promising, but it seems a matter of regret that only six pairs should be shown of a breed remarkable for early development.

Crèvecœurs. A few fine adults of this magnificent table-fowl appeared, but no chickens at all.

There was a good entry in both classes of *Andalusians*, a breed both beautiful, and useful as excellent layers; the quality was fair throughout.

Minorcas, another excellent egg-producing breed, were well represented in both classes.

Leghorns were more numerous in the adult than in the chicken classes, though some of the latter were forward for their age, the pullets giving great promise of early laying.

All the four classes of *Hamburghs* contained fine and meritorious specimens, some of the chickens other than black being very forward for this cold and inclement year.

Game. In 5 out of the 6 classes for these breeds, there were a few excellent specimens from a fancier's point of view; in the class for Brown Red Chickens there was no entry at all. Considering the chief objects of the Royal Agricultural Society, I would venture to suggest that it would be well to allot one or more classes to specially useful breeds of game-birds, and to give special instructions to the Judges to judge them as such. In the absence of such special directions, a Judge can only make his awards according to the standards generally accepted at present among poultry fanciers. I thus regretfully felt myself obliged to leave out of the prize list a pair of old-fashioned white-legged "Derby" Black Reds, a hardy race of good table fowls, peculiarly useful for crossing. In the case of most breeds, the points insisted upon by fanciers are those which make the breed specially useful for some particular purpose. In the case of game, unfortunately, it is not so; the length of leg now required makes the race unsuitable for the table, and peculiarly liable to weakness in the hocks.

Waterfowl were fair throughout the classes. The time of year is unsuitable for the exhibition of adult ducks; the classes for young ducks were not so well filled as we should have expected them to be.

The class for *Black or Bronze Turkeys* contained several magnificent pairs, the hens in the first prize and second prize pens being super-excellent. In the class for Turkeys of any other colour, a pair of Bronze birds were shown, which obviously should have been entered in the other class.

Before closing this report, I may perhaps be allowed to make a few sug-

gestions for rendering this Poultry Show of the Royal Agricultural Society more popular another year, and therefore more widely useful.

1. I would suggest that there should be classes for chickens of such first crosses as are found to be specially good for table or for laying purposes. I do not wish to be mistaken, or thought to encourage generally the keeping of mongrel fowls. I fully recognise the high use of distinctive breeds of poultry, as of other live stock, with strongly marked characteristics; and more than that, I believe that poultry fanciers have been of great use to the country by aiding in the production and perpetuation of such distinctive races. As in the case of horses, cattle, and sheep, it has in the first instance been the enthusiasm of the fancier which has attempted and drawn attention to the improvement of breeds of poultry. But for the farmer, first crosses from these pure races are often the most advisable stock to raise, as coming to earlier maturity than the pure breeds themselves, and as being more hardy. It would therefore obviously be of use to set before those who regard poultry solely from a commercial point of view, examples of the size and excellence to which young birds from such crosses may be brought in a few months.

2. I would suggest that all birds shown in such classes should be on sale at moderate prices to give purchasers an opportunity of testing the quality of the chickens; indeed, it might be well to give additional classes for pure-bred chickens to be entered on the same conditions.

3. I would lastly suggest that prizes should be given for hen's eggs. These are usually shown in collections of a dozen, each dozen necessarily coming from hens of one variety or of one cross. It is usual for eggs to be divided into two classes, one of white, the other of coloured eggs. I invariably find this classification popular, and accompanied by large entries.

OSWALD ERNEST CRESSWELL.

XXXII.—*Report on the Horse-shoeing Competition at Nottingham.* By CHARLES CLAY, Walton Grange, Wakefield, Steward of Horse-Shoeing.

As Steward of the Horse-Shoeing department it is my pleasing duty to present a second report for publication in the Journal. Speaking generally, the proceedings were a complete success, and the public interest in this question seems to be as keen as ever, the stand being besieged throughout the trials by an attentive crowd. Many influential ladies and gentlemen were kind enough to visit the yard in spite of the unavoidable smoke, and to take considerable pains to acquire a knowledge of the various operations then going on. This I look upon as one of the best features of these competitions. It is only when the public and those interested in horses awake to the fact that our present system of horse-shoeing is wretchedly bad that any hope of improvement can be looked for; and nothing is better calculated to open their eyes than to watch a competition of this sort, and to witness the inferior work of some of the men, who, from no fault of their own, are under the fond delusion that their doings cannot be improved upon.

The prizes offered by the Society were the same as last year, viz. 6*l.*, 4*l.*, 3*l.*, 2*l.*, and 1*l.*; but there were only two classes of competitors in place of four, Class 1 being for hunters, and Class 2 for agricultural horses. In addition to these prizes the Lincolnshire Agricultural Society very generously added half those amounts in cases where the winners came from that county. Moreover, the Worshipful Company of Farriers most handsomely offered to elect the first-prize men in each class members of their guild free of cost, an honour which in itself should stimulate our shoeing smiths to advance in their profession, and I am sure will be highly appreciated both by the present and future prize takers.

The Competition was confined to Shoeing Smiths residing in the district for which the Nottingham Show was intended to serve, viz. the counties of Derby, Leicester, Lincoln, Northampton, Nottingham, and Rutland. Each competitor was required to forge and fit a hind and fore shoe and to put the fore shoe on. The hind shoes were retained by the Steward, and those made by the five prizemen were subsequently deposited at the Society's house in Hanover Square as samples for future reference.

The number of entries was 48 in Class 1, and 45 in Class 2. Competitors were allowed to enter in both, and 34 men in Class 1 consequently appeared again in Class 2. I am not quite sure that this is a desirable arrangement, and it may require revision hereafter.

The time test was omitted this year as an experiment. This was certainly a mistake, and resulted in such very dilatory proceedings that I was requested to warn the men when Class 2 came on that the Judges would take note of any evident waste of time. This had the effect of improving the speed of the work considerably, and, strange to say (as appears also in the Judges' remarks), the average quality of the work was much better.

In my last year's report I ventured to state my opinion that "most of our best shoeing smiths are very deficient in knowledge respecting the anatomy of the horse's foot." It was one of the objects of the present competition to ascertain definitely whether there was sufficient ground for such a serious statement. For this purpose the Judges, at my request, drew up the following half-dozen simple questions, and put them to twenty-five of the best selected workmen separately—

1. How many bones are there in a horse's foot?
2. Name them.
3. Where is the hoof of the fore foot the strongest for holding the nails?
4. Where is the hoof of the hind foot the strongest?
5. What is the use of the frog?
6. How is the hoof attached to the sensitive part of the foot?

I regret to say that not one of the candidates could answer all the questions correctly, and to my great surprise several of the men confessed they knew nothing about these things, and had not given any attention thereto. The answers given by others, although often amusing, displayed a most lamentable ignorance of even the common names of the various parts, and only in one or two instances was any approach to scientific terms applied to them.

Under these depressing circumstances it becomes a very serious question how to deal with this matter in future. That something should be attempted to raise the shoeing of horses to a higher and more scientific position is, I think, now beyond all cavil.[1] It is evident that the smiths themselves are not in a position to acquire the necessary education, and I am sorry to say the veterinary profession do not seem to give the attention to this question which I think it demands from them. I am informed that horse-shoeing is usually considered as not altogether within their purview, that it is a farrier's business entirely, and that if improvement is desirable the smiths must take up the matter and improve themselves. This is an easy way out of the difficulty, and may be very well from a professional point of view; but I would ask: How are the smiths to acquire this knowledge? If none of them are in a position to teach even themselves, they cannot certainly impart the information to their workmen and apprentices, and so the rule of thumb must remain their standard, to the continued detriment of our horses' feet, with all its consequent evils.

Surely this only points to the necessity for the Royal Agricultural Society interesting itself more earnestly in this question, and by distributing printed matter with plain intelligible drawings and possibly cheap models of the horse's foot, and by other means available, to endeavour to raise the status of the men employed in this business.

I would venture to suggest that our veterinary surgeons might with advantage be induced to acquire a practical as well as a theoretical knowledge of horse-shoeing, so that they should be able themselves to forge the shoes and fit them on. The Royal Agricultural Society, having satisfied themselves by examination and practical tests, might grant certificates to such surgeons throughout the country, and it should be the duty of the latter, for some small fee, to teach the smiths in their respective districts the scientific principles of horse-shoeing, and see that they

[1] In support of this I may add that the answers given to the same set of questions at the shoeing competition of the Great Yorkshire Agricultural Society held in Huddersfield in August last were equally unsatisfactory.

were carried into practice. Owners of horses would, I feel sure, be glad to support such efforts by giving preference to men so instructed, and my own opinion is, that until owners, trainers, grooms, jockeys, and all connected with horseflesh, insist upon a higher standard of efficiency, the same old routine will continue until Doomsday.

My experience at these shoeing competitions (now extending over many years) and inquiry in other quarters lead me to the conclusion that there is much more mischief going on in the country in this respect than most people are aware of. The damage is not only serious as an agricultural question, but I have every reason to believe that to our thoroughbreds this much-neglected matter of horse-shoeing is of vital importance.

It is not quite within my province here to suggest that many of our finest racehorses are not unfrequently "most mysteriously amiss," and "suddenly go wrong," for which the shoeing smith is very often responsible, although in many instances he is only carrying out the imperative orders of either the trainer or jockey or some one in authority, who fancies a newly rasped and polished hoof, together with "a nice clean cut frog," will in some unaccountable way help to win the race, or at least catch the eye of the betting fraternity, and assist to "raise the price." If I can secure aid even from this outside interest, by pointing out the importance of the shoeing question to them, I trust I shall be excused referring thereto in this report.

Whether they manage these things better abroad than we do, I am not prepared to say; but I observe that a very extensive horse-shoeing competition at Brussels has recently taken place, for which, as I understand, no less than 180 competitors were entered. In the regulations of this competition the first importance was attached to the theoretical part of the examination, as the men were not permitted to shoe a horse until they passed the veterinary examination. Under such conditions our competitions would terminate in a summary manner; yet I am inclined to think we shall improve the character of our trials by giving points another year to the competitors in proportion as they pass the anatomical examination creditably or otherwise.

As last year, I must express a hope that the Council will now continue in the course so well started, and allow these competitions to continue annually until some other and better plan can be devised, as I think we must acknowledge there is a wide field for improvement, and a mass of ignorance and prejudice which can only be removed by the judicious application of "Practice with Science."

In conclusion, let me thank the Judges, whose report I

append, for their very careful attention to their duties, for the infinite pains taken to select the best men, and their evident desire to impress upon the candidates the necessity for improvement both theoretically and practically in their important calling.

Report of the Judges of Horse-Shoeing.

Class 1. *Hunters.*—When we considered that the district open to competitors this year embraced the hunting counties of Derby, Leicester, Lincoln, Northampton, Notts, and Rutland, we naturally expected to see a large percentage of the work done in a skilful manner; but in this we were much disappointed.

Of the 48 competitors entered, 46 appeared. Before beginning work we addressed the whole of the men in both classes, with two or three exceptions, and cautioned them against a too free use of the knife and rasp, also against burning the foot. As the horses to be shod varied considerably in size in Class 1, we particularly requested the competitors in that class to remember that they were supposed to be shoeing hunters, and that the shoes were to be adapted for that purpose, keeping carefully in view the character of the foot allotted to them for shoeing. We are confident that our remarks as to cutting, rasping, and burning the foot had a good effect, but we regret to say that little or no attention was given to the size of the horse or the character of the foot, and although different sizes of iron were supplied only one size was used. Hence horses with large flat feet, that as hunters could have carried from 16 to 18 stones, were shod with shoes very much too light, and which would have been not only useless in actual work but positively injurious. One big mare was the cause of our disqualifying three men, as each of these men made shoes wholly unfitted for the animal. In other cases little light horses with small feet had too much iron to carry.

The recorded time test was very bad: it varied from 39 to 88 minutes. This was largely attributable to the time consumed in filing and polishing the shoes—a process that was carried out to a ridiculous extent. The average time was 57 minutes. Only one competitor was less than 40 minutes, ten from 40 to 50 minutes, seventeen from 50 to 60 minutes, and the remaining men exceeded one hour. We observed in many cases that the nail heads were rasped down when the shoe had been nailed on and "clenched" up. This ought not to be necessary, and is not so with really good workmen.

Class 2. *Agricultural Horses.*—In this class the work done was far better than in Class 1, and we were pleased with the general result. Forty-five competitors entered, but two were absent. With few exceptions the work was really good—the shoes well-shaped, strong and sound, and adapted to the feet and description of work the horse was expected to do.

The recorded time was a great improvement upon that in Class 1. It varied from 25 to 57 minutes—the average being 31 minutes, which is too long for this sort of work. We think it only fair to mention that the first prize winner was a young man only 21 years of age. His work would have been a credit to any man—it was wonderfully good, especially under the disadvantage of the foot he had to shoe being the worst in the whole collection of horses. The winner of the second prize was also a young man, 22 years of age, but his work was far behind that of the first prizeman.

At the close of each competition we examined the best workmen (25 in all, 14 in Class 1 and 11 in Class 2) as to their knowledge of the structure and uses of the various portions of the horse's foot. We found that very few indeed had any but a confused idea of this subject, and we may,

speaking broadly, assert that the best men at their work knew the least about the foot.

We respectfully suggest that if in future competitions examinations are to be held on the structure and uses of the different parts of horses' feet, the men should be supplied, along with their entry forms, with some plain brief information on the subject, and that models, drawings, and preparations of feet should be on view during the competition.

We further beg to suggest that seeing how much time is wasted in superfluous "finish" of the shoes, some limit should be fixed for each class—say from 30 to 45 minutes—as the period in which the work ought to be done.

Your excellent Steward in this department, to whom we feel deeply indebted for the pains he took in making such complete arrangements for the carrying out of the necessary work, and for the unflagging interest he took in the proceedings, was present during the examinations taking notes of the few very simple questions put by us and the answers given, and we leave him to make any further remarks he may think fit on the subject.

CLEMENT STEPHENSON.
JOSEPH M. PARKER.

XXXIII.—*The Structure of the Horse's Foot and the Principles of Shoeing.* By Professor G. T. BROWN, C.B., Principal of the Royal Veterinary College.

FROM the title of this paper a very long and scientific account of the anatomy and functions of the horse's foot, with a history of the art of shoeing from the earliest times, might be expected. The writer intends, instead, to produce a very short and practical essay for the use of practical men, leaving the antiquarian and the learned inquirer into the mysteries of the art to consult the classical work on Horse-shoes and Horse-shoeing, by Dr. George Fleming.

Most persons, when thinking or speaking ot the foot of the horse, have in their minds the idea of their own foot as an organ by the aid of which they stand, or walk, or run. But the first step in the inquiry must be to show that the horse does not put his foot on the ground at all, but only a small portion of it; and that the organ which is always called the foot of the horse, is really the point of the toe. A few drawings will make this clear.

In the figures in Plate 1 (page 660), *a* is the hind foot of the horse, complete with the full set of bones; *b* is the foot of the man, with the like set of bones. A glance at the cuts is enough to prove that the bones of the human foot lie along the ground from heel to toe; while the horse's heel, being in fact the point of the hock, is some two feet or more off the ground.

In Plate 2, on page 661, there are two figures which show what would happen if the horse could or did put the whole of the foot on the ground as the man does, and if the man were to support himself with his toes only on the ground, as the ballet-

dancer does sometimes, after long and painful training, and the horse does always without any effort at all.

After grasping the idea which the woodcuts are meant to convey, it will be easy to go on a little further, and find out how the toe of the horse is made to serve the purpose of a foot chiefly by the extra growth of the nail, which instead of being a mere horny scale on the top of the toe, covers the part all over like a case or box of horn. The bones of the fore foot may in like manner be compared with those of the hand and wrist of man. But as the human hand is not used to support the weight of the body nor to assist in moving it, the human foot furnishes the best type of the foot of the horse.

In beginning the inquiry about the structure and uses ot the foot of the horse, it is most natural and easy to take the outside part of the organ, and in so doing it will be best to compare the foot of the horse with that of the foal at birth, before the organ has been used to bear the animal's weight. Plates 3 and 4, on pages 662 and 663, show the external form of the foot of an adult horse, and Plate 5, on page 664, that of a foal, and it will be noted at once that there is a great difference in the state of the horn, especially at the bottom of the foot in the two specimens.

In the adult foot, as it is seen resting on the ground, the wall of horn *a*, from the hair at the coronet down to the ground, is first noticed, and for the purpose of description it is divided into several parts. Exactly where the skin joins the hoof is the coronary ring *d*. The outside of the hoof is the wall or crust. At the back of the hoof are the heels, *c c*. A portion in the front *a*, is called the toe, and the sides of the wall are the inside and outside quarters. Only imaginary lines mark the points of separation of these different parts from each other.

In thickness, the wall of the foot varies according to the size of the animal and the treatment it has met with from the rasp of the shoeing smith. An average of half an inch may be taken as near enough for practical purposes.

Having made out the general characters of the outer surface of the hoof as it rests on the ground, the next thing to be done is to lift it off the ground and look at the bottom of it, which can be seen in the next figure (Plate 4, on page 663). The parts exposed to view are the crust (2), bars (3), sole (1), and frog (4). The crust is turned in at each heel to form the two bars which meet nearly in the centre of the circle, leaving a triangular space behind which is filled up by the mass of soft horn called the frog, and a half-circular space in front, in which is the sole. In form the sole is concave at the bottom and convex above, as may be proved by dissection. But in the foot

which has been left for some weeks without the smith's care, the ground surface will be nearly flat—crust, bars, frog, and sole forming one rough level, covered with loose pieces of horn breaking off from the sole and frog, which organs want no help from the knife to keep them in proper condition.

Between the fully formed foot of the horse and the half-grown foot of the newly-born foal, there are important differences, which may easily be seen, as specimens of both organs are common enough. The first thing which strikes the observer is the great difference in the arrangement of the base of the foot in the two animals. In the hoof of the foal (Plate 5, page 665) the fibres of horn at the bottom of the foot are continued to a point, the fibres being joined together not unlike a half-cleaned paint-brush. No frog or crust or bars can be seen in this specimen; but, after a few days' contact with the ground, the brush-like masses of horn fibre are broken off and the sole becomes flat or slightly hollow, but never presents the deeply concave form until it has been brought under the knife of the shoeing-smith.

Up to this point only the horny covering has been described as it is seen without dissection; and it is now time to see what is to be seen by taking the foot to pieces. The workman who is fond of his work will look beyond the surface, if only for the sake of finding out the nature of the things he has to deal with. He may proceed in many ways, all leading to the same end, and it is not a matter of much moment whether he begins by taking off the hoof and then working inwards to the bone which is the foundation of the foot, or makes a cut which will enable him to see at one view all the parts of which it is made up.

Perhaps it will be most interesting to begin by seeing the structures in their proper position. For this purpose a cut must be made quite through the centre of the organ. In Plate 6, on page 665, a section of the kind is drawn from a specimen which is so thin as to be transparent, and the various parts are represented as seen by a low magnifying power. The parts shown are *a*, skin of coronet; *b*, fibres of coronary frog band; *c*, fibres of wall; *d*, horny lamina; *e*, fibres of sole; *f*, fibres of frog; *g*, section of coffin bone; *h*, section of navicular bone; *i*, section of flexor tendon; *k*, section of coronet bone; *l*, section of fatty frog.

A careful inspection of the figure, and close reading of the description, will give the reader a fair idea of the arrangement of the parts which are included in the foot, and assist him in the next step in the inquiry, which will consist in taking the foot to pieces and looking at each part separately.

When the hoof is taken off by the aid of heat, or by soaking for a time in water, the internal foot is displayed, and also the inside of the horny box; and the drawings in Plates 3 and 7 (pages 662 and 666) show these parts after separation. The points for special notice are the very perfect fitting of the internal foot to the inside of the hoof. The coronary band (Plate 7, 1–3) of the one rests in the hollow in the upper part of the hoof (Plate 3, *d*), the folds of membrane (*laminæ*) of the internal foot (Plate 7 (2)) are lodged between the horny folds (*laminæ*) of the inside of the hoof (Plate 3, *a*), and the sole of the internal foot, with the frog and the bars, find their exact counterparts in the inside of the hoof which they form for their own covering and protection. See Plate 8 (page 667), which shows the bottom of the foot: (1) coronary band continuing to sensitive frog (4); sensitive lamina (2) continuing to bars (5); sensitive sole (3).

After the hoof is off there is nothing in the way of the knife, which may now be used to take off the membrane which secretes the horn. The observer will find that the tissues beneath are bone, fibrous structure, fat, and cartilage. The bones actually inside the hoof are the pedal bone and the navicular bone, both of which are shown in Plate 9, figures A, B. To the pedal or coffin bone are fixed two wings of cartilage (2, 3), also seen in fig. A, and in the space between the cartilages is a mass of fibre and fat, making together an elastic pad which Coleman called the "fatty frog."

It will be noticed that the pedal bone is a very dense structure, like ivory in hardness, and also that there are many canals passing through it in various directions for the passage of blood-vessels to supply the secreting membrane with blood. Branches of nerves are also very numerous, and the membrane of the internal foot is therefore correctly described as a highly vascular and sensitive structure.

The navicular bone (Plate 9, B) is known as the seat of the navicular disease, which is a common cause of serious and often incurable lameness in the forefeet. It is also remarkable for the extent of its joint surfaces compared with the size of the bone. Its upper surface forms part of the coffin joint with the short pastern. In front (2) it joins the pedal bone, and at the back (1) it forms a joint with the main flexor tendon, which passes over it to be fixed to the bottom of the pedal bone. This is the joint in which navicular disease occurs.

Functions of the Foot.

After seeing all the parts which form the foot of the horse, the inquirer will begin to speculate about the use of each, and will most likely do what has been done before, viz. invent clever

theories which will not stand the test of common sense, and will rather hinder than assist him in deciding what plan of shoeing is the least open to objection.

Taking the foot as a whole, it is evident that it is so formed that it can support the animal's weight, at the same time that its various parts yield under pressure just enough to avoid concussion. The hoof is produced as fast as the wear and tear, under natural conditions, make new material necessary. So long as the horse is left to take care of himself and his feet, all goes well; but when man sets his needs in place of the animal's instincts, things commonly go wrong, and the hoof among other parts gives way.

The first and most important function of the foot then is to keep itself in repair, a work which it performs well within certain limits.

Next, the hoof horn is wanted to protect the internal sensitive structures by which it is formed, just as the outer or scarf skin covers and protects the true skin. The scales, which are the elements of the outer skin, and hair become crowded together to form the hoof, which is really a mass of hairs glued together, and it adds to toughness and density a fair degree of elasticity. Perhaps if we had contrived to use our horses with such care that shoes would not have been required, we might by this time have been in possession of a race of tough-hoofed horses, for which the services of the shoeing-smith would not have been wanted.

Lastly, the function of the foot is to afford the horse a firm support and secure hold of the ground at all paces. That the hoof yields under pressure is admitted. That it spreads out, as some people contend, when it is placed on the ground, is denied by all who have carefully looked at the arrangement of the parts of the organ in their relation to each other. The suggestion that the foot expands so much that the shoe ought to have a hinge at the toe to allow the movement to go on without hindrance is not worth discussion, nor, indeed, is any point connected with the theory of ground surface expansion and the tendency of the concave sole to assume the form of a plane under the pressure of the animal's weight.

The whole theory, in fact, may simply be left to the ingenious persons who are fond of splitting straws. The practical man need not be concerned about such matters. His own common sense will teach him that the base of a horse's foot cannot expand, nor the sole descend to any extent without tearing the inside of the hoof from the internal foot to which it is everywhere closely and securely attached.

When the sole does descend it is the result of disease, and then it does not ascend again, but remains in its distorted state.

Principles and Practice of Shoeing.

It seems to be impossible in the present circumstances to dispense with the iron shoe to save the hoof, and it will be a wise thing to decide at starting on what principles the practice which has been in operation from early times shall be carried on. No question of art or science has caused more disputes than this, and yet, so far as principles are concerned, nothing can be more simple. The basis of the art of shoeing is, or should be, the principle of non-interference, and it is not easy to carry this principle too far. Nothing can be better for the purposes of the horse than the foot in its natural state. While, therefore, trying to save it from too rapid wear, the most simple means should be used, and the organ left alone as far as may be. To this end a little knowledge of history will be useful.

No one can say at what date the art of shoeing began; but it can hardly be doubted that as soon as horses were used by man for his pleasure or profit, it was found out that the hoofs which served the animal well so long as he was left to himself, were worn more quickly than they grew when his master fixed the amount of work which the horse was to do. In such circumstances, some protection was required, and it may be supposed that the first idea of the human owner would be to adapt some sort of sole to the bottom of the foot, much as he did for his own feet; and it is not unlikely that his first attempt at fastening would be by means of strips of hide or thongs which he used for his own feet as fastenings for his sandals. These failing, as they always do, iron spikes or nails would offer themselves as a means of fixing iron shoes to the horn. Dr. George Fleming, in his article on the Principles of Shoeing, in Part I. of the Journal of the Society for 1881, remarks that the art of shoeing was probably known as early as B.C. 300, as a coin of that date has on it a figure of a horse being shod. The same author also observes that in a climate like ours, some substantial hoof armature must have been desired by a horse-and-chariot-driving people like the ancient Britons, and further that the superstitions which still cling to horse-shoes appear to be derived from the Druids, who were not only priests but skilled workers in metals.

Having regard to the time that has passed since shoeing was first practised, and the amount of care and thought which scientist and mechanic have bestowed upon every detail connected with the foot and the shoe, the practice ought now to be perfect. But in reality we seem to have progressed in a crab-like fashion. It is not flattering to the workman of the nine-

teenth century to be told that the "children of the desert" did better things in the way of making and fixing shoes to horses' feet than are done now; but there are good reasons for the statement. The Arab shoe was light, it protected the bottom of the foot from injury, the nails had very large heads, and were so driven that only the lower part of the crust was pierced, and the heads of the nails gave a better foothold than is obtained by the modern system of shoeing.

The drawing in Plate 10 (page 669) shows the form of the Arab shoe, copied from Dr. Fleming's work on Shoeing, and it is evident that this thin flat plate of iron can be fastened to the foot in such a way that the whole of the bottom of the organ, the crust, the sole, and the frog, shall be equally pressed. In fact, the Arab shoe is in the position of a thin sheet of iron between the bottom of the foot and the ground, causing the least interference with the natural tread.

Let us now take the modern shoe and present system of applying it to the foot. First, as will be seen by Plate 11 (page 670), the shoe is a narrow rim of iron, with the nail holes so close to the outside edge that the nails must be driven some distance up the wall of the hoof to get hold enough to keep the shoe on. Then the inside of the shoe is often beaten out (seated), so as to rest on the crust only while the sole and frog are pared away, and all the parts of the ground surface of the foot which should help to support the animal's weight are lifted off the ground. Plainly stated, the Arab shoe allowed the whole of the base of the foot, wall, sole, and frog, to rest on a hard surface. The modern shoe lifts the greater part of the base from the ground, and thus the whole of the horse's weight rests on the edge of the wall. The diagrams in Plate 12 (page 671) will show the difference in the results of the ancient and modern system.

A system of shoeing, known as the Charlier system, has of late years attracted some attention and even made some progress. Many difficulties stand in its way, but in its principle the plan is as near perfection as possible. The Charlier shoe is a narrow rim of iron which is let into the wall of the foot for a certain distance round the toe and quarters, leaving the whole of the bottom of the foot to take its proper place on the ground. A foot thus stood is as nearly in a natural position as it can be with any form of shoe. The organ is better placed than with the Arab shoe, because the bottom of the foot is in contact with the earth, instead of with an iron plate, and in either way the foot is better off than with the ordinary shoe, because with that the sole and frog are in contact with nothing at all.

Keeping in view the true principles of shoeing, the advice

which is to be given on the practice of the farrier's art may be put into very few words.

To begin with, all efforts at neatness of finish by the aid of rasp and oil-brush to the wall of the hoof should be at once discouraged. The sole, bars, and frog, dirty, ragged, and scaly as they will be when the horse comes to be shod, should be left alone.

By the use of the rasp the crust may be lowered as much as in the judgment of the farrier is required, and the front of the foot will always have to be rasped more than the quarters or heels. The skill of the smith is shown in his ability to keep a perfectly level base, so that the horse standing on the unshod foot has a natural position. No doubt can be felt as to the truth of the maxim that the shoe should fit the foot so that no after rasping is wanted. Fitting the shoe without applying it hot to the crust is easy to a good workman, but no great harm is done if the hot iron should be kept in contact with the horn for a few seconds. The farrier who is forced to adopt the device cannot, however, claim to be a master of his art.

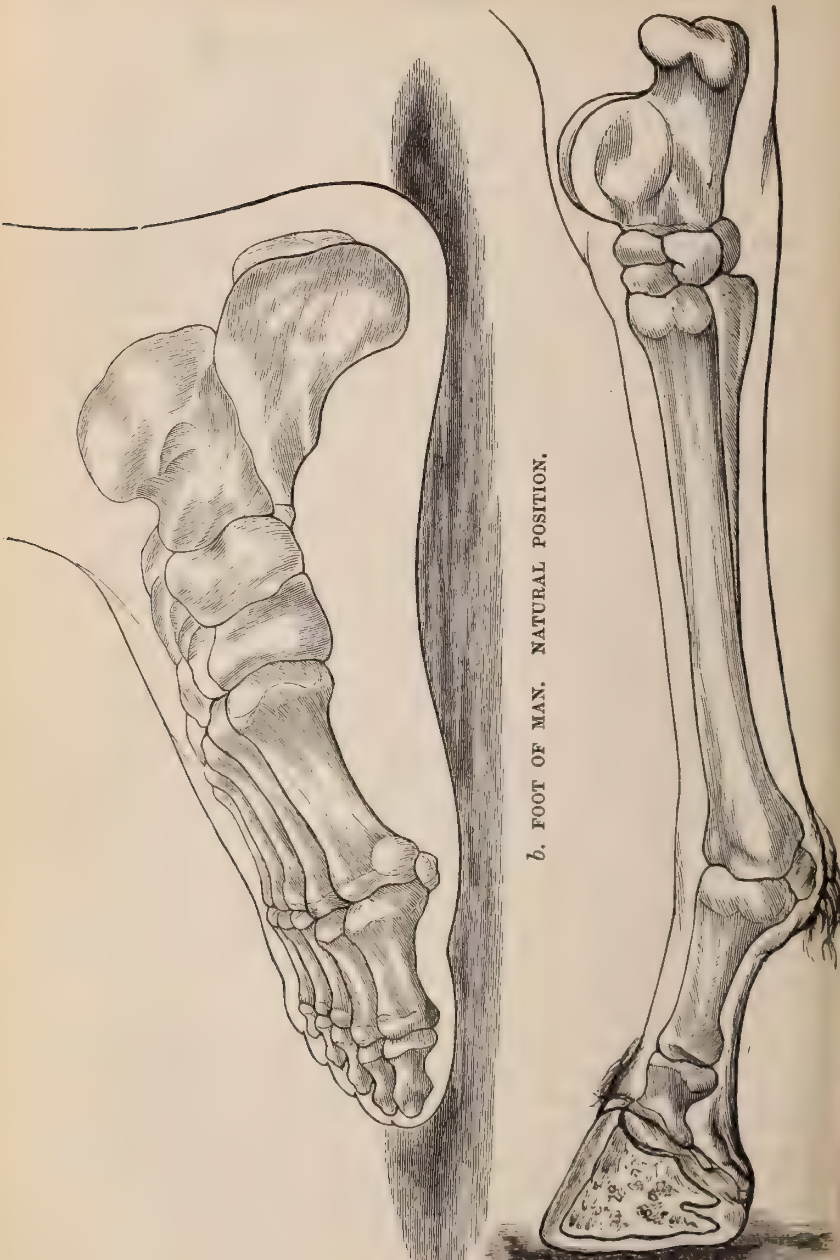
Nails should be driven so as to take a short and wide hold of the crust, and if the shoe can be secured by three nails on the outside quarter, and two on the inside, the work is well done; every additional nail driven into the foot, especially the forefoot, demands some sort of apology, or at least explanation.

A concave ground surface for the shoe gives a far better hold than a flat one, and if with that arrangement the frog is in full contact with the ground, it will be possible to do without calkins for the hind shoes of all horses which are not required for heavy draught-work in hilly districts.

Before, however, the present system of shoeing can be altered to conform to the rules laid down in this paper, the horseman and his servants, rather than the farrier, must be taught. At the present time no shoeing-smith dare send home a horse shod in the way which is known to be the right one, because the master of the animal and his men would denounce the work as crude and unfinished, and solemnly promise never to choose the same workman again.

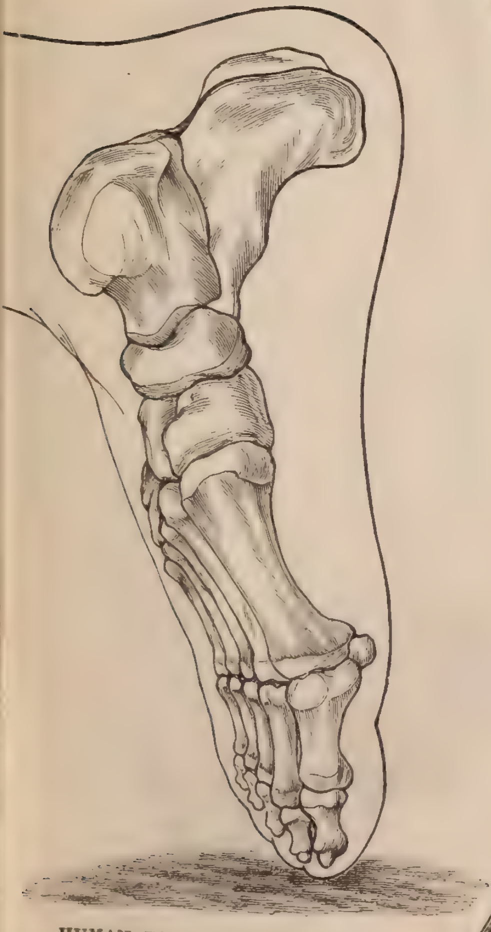
If a few final words are necessary, they must take the form of a protest on the part of the writer that there is nothing in the foregoing remarks on the horse's foot and the principles and practice of shoeing which has not been said and written over and over again by competent persons: nothing, indeed, which is not well known to all veterinary authorities and to many of the best practitioners of the art of shoeing. But the awkward thing is that between knowing how to do, and doing, there is a gap to fill up which takes a long time.

PLATE I.



b. FOOT OF MAN. NATURAL POSITION.

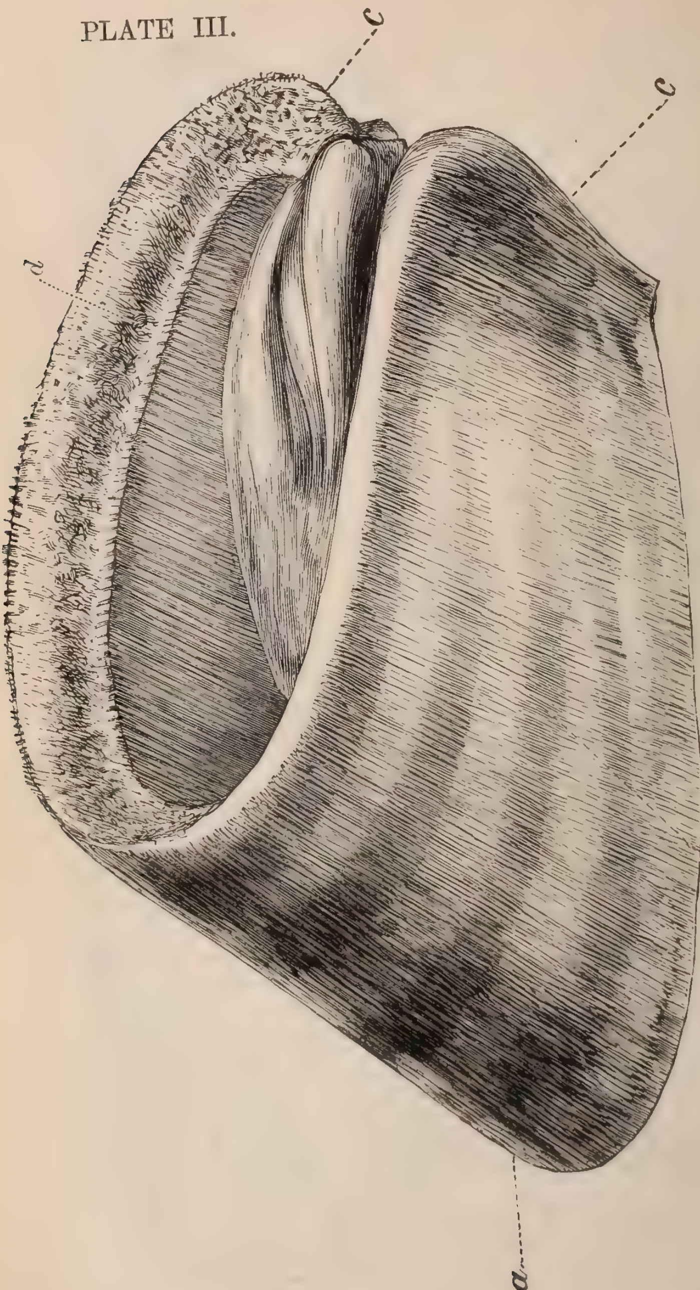
PLATE II.



HUMAN FOOT, TOE ON GROUND

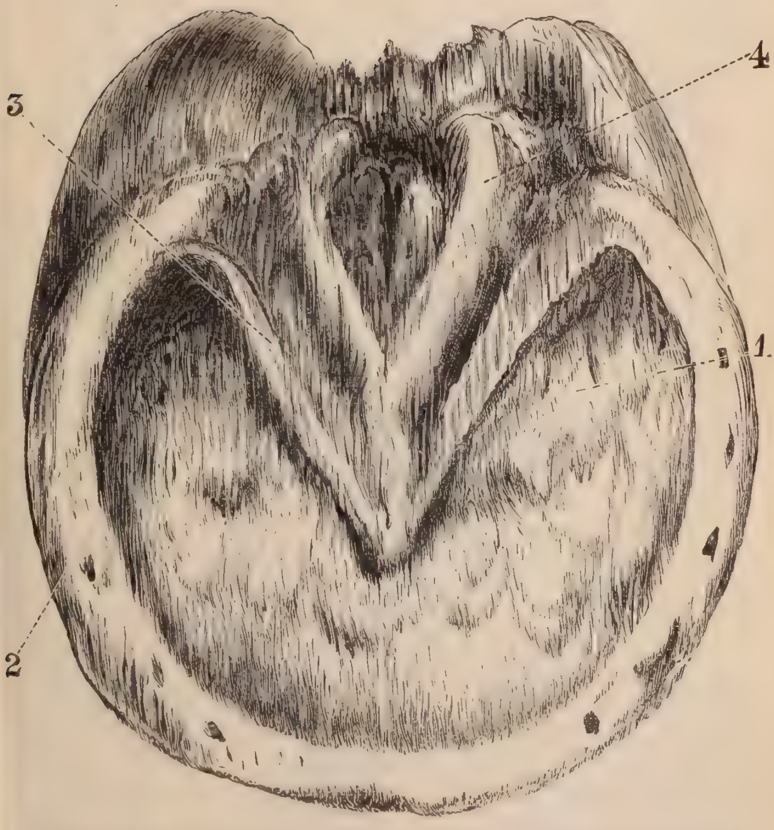
WHOLE OF HORSE'S FOOT ON THE GROUND.

PLATE III.



HOOF OF HORSE.

PLATE IV.

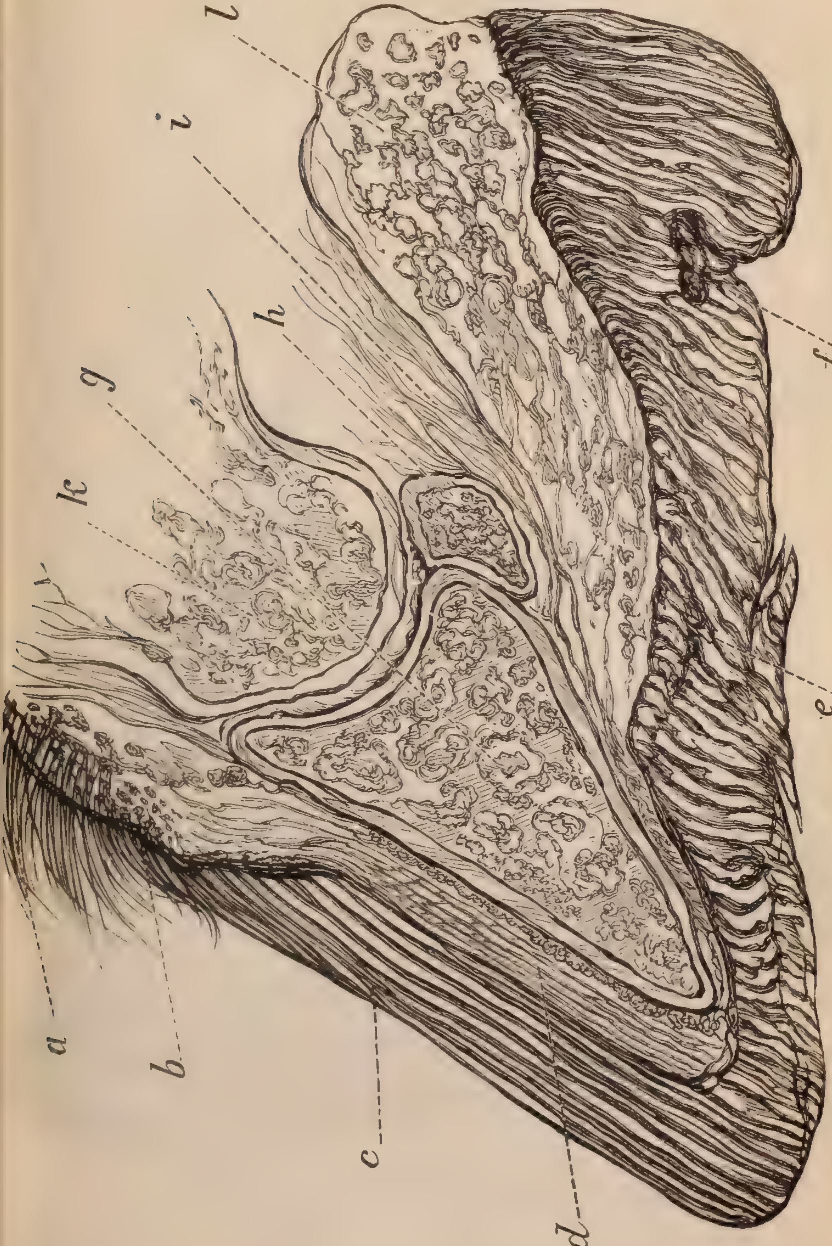


GROUND SURFACE OF HORSE'S FOOT, SOME WEEKS AFTER SHOEING.

PLATE V.

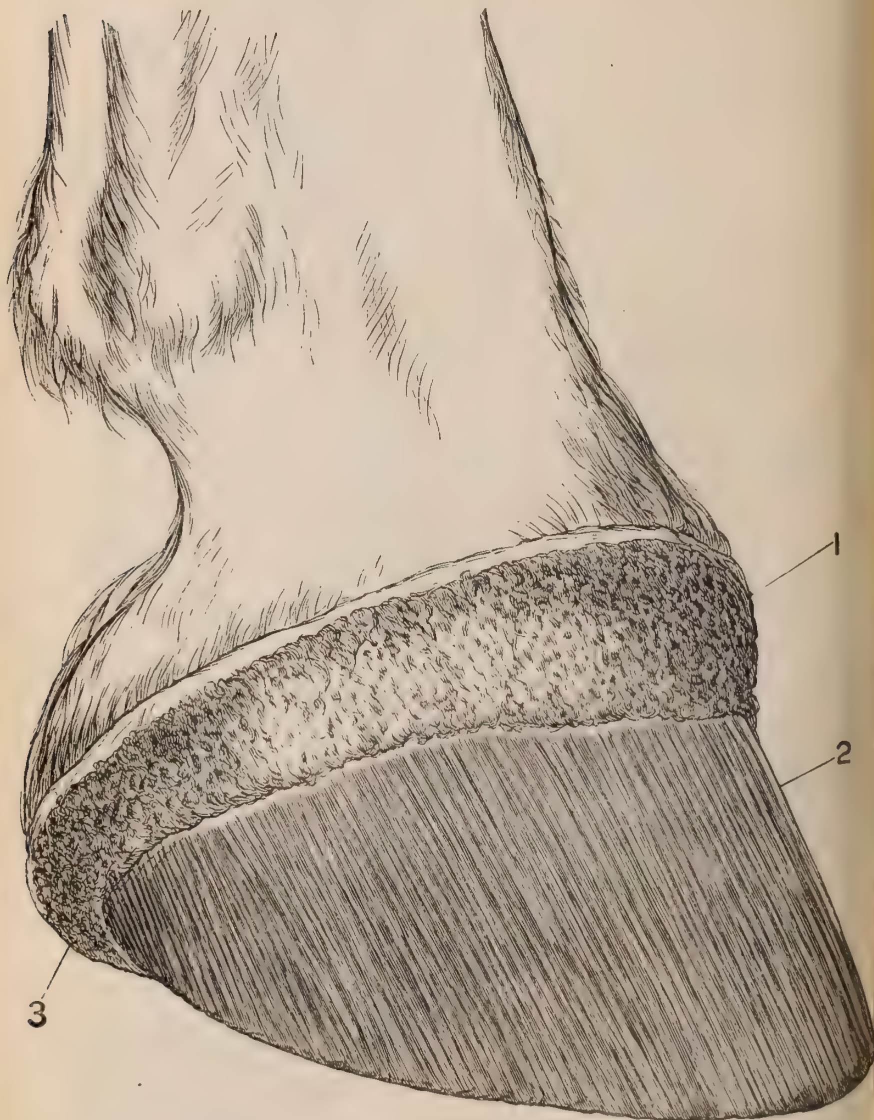
FOOT OF FOAL.

PLATE VI.



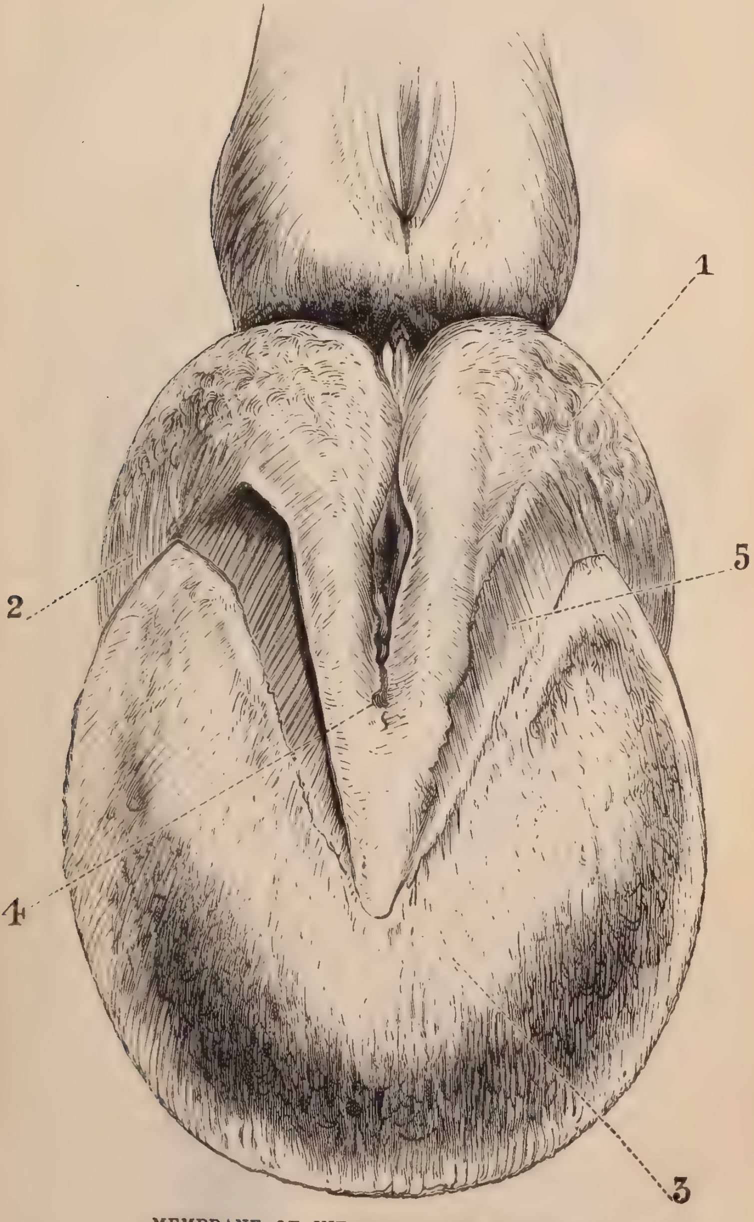
SECTION THROUGH CENTRE OF HORSE'S FOOT.

PLATE VII.



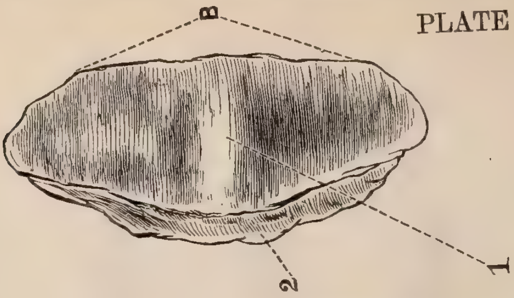
MEMBRANE OF INTERNAL FOOT. HOOF REMOVED.

PLATE VIII.

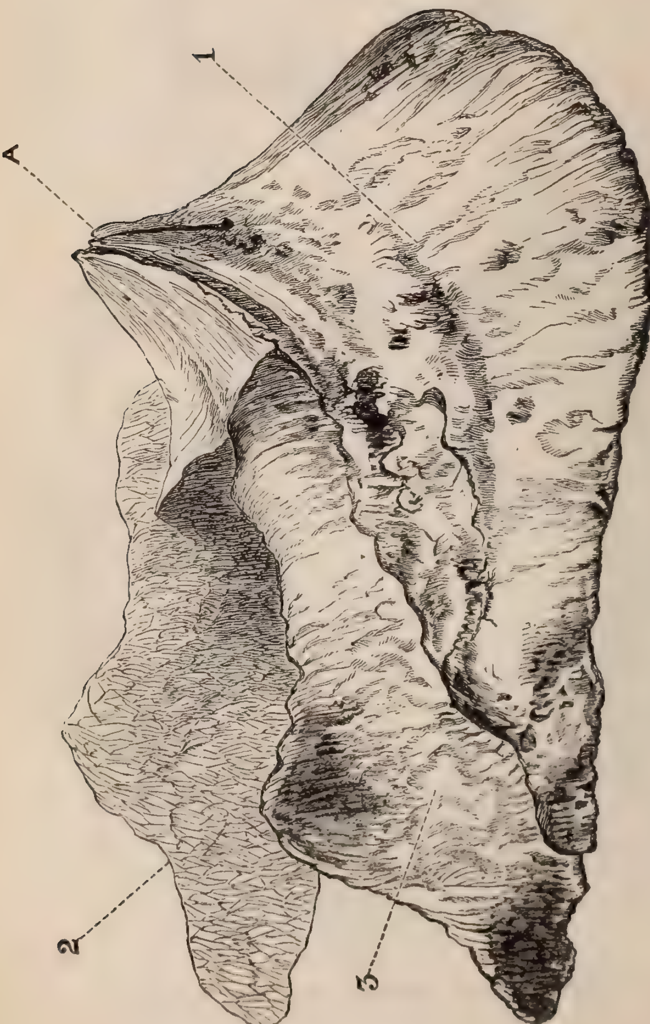


MEMBRANE OF INTERNAL SOLE AND FROG.

PLATE IX.

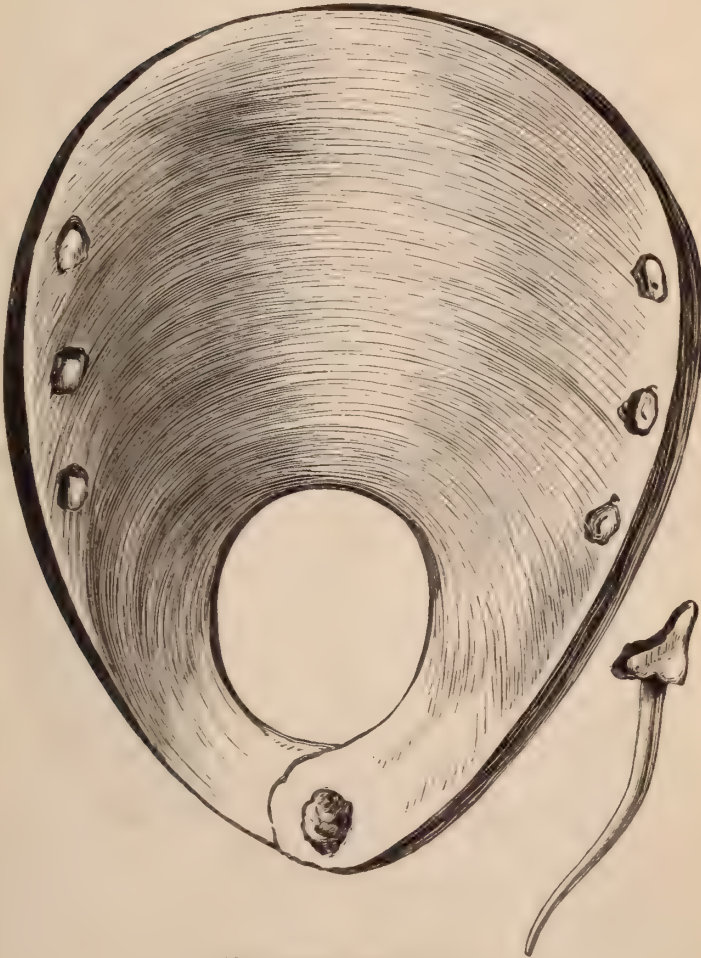


NAVICULAR BONE.



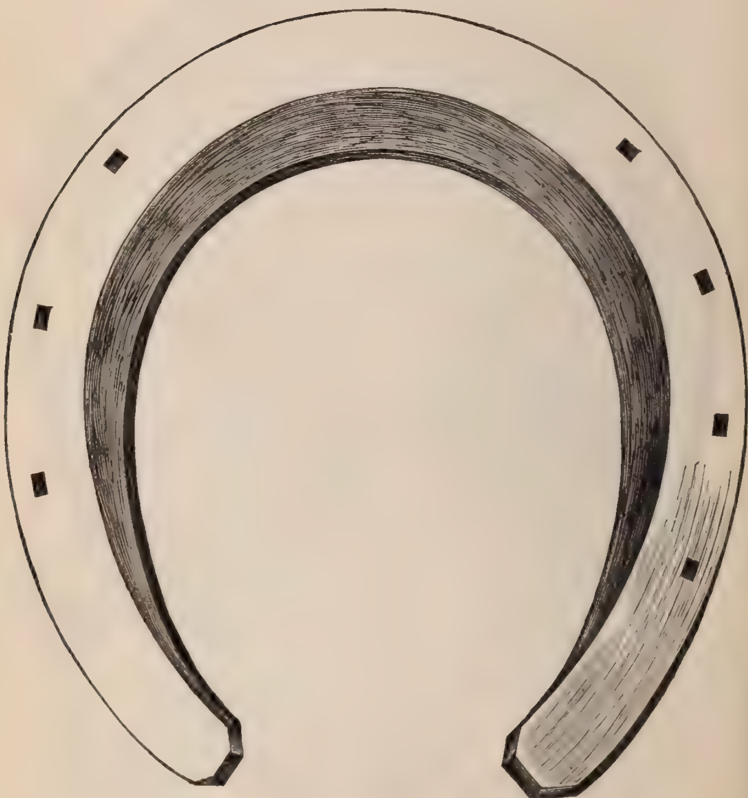
PEDAL BONE WITH LATERAL CARTILAGES.

PLATE X.



ARAB SHOE AND NAIL

PLATE XI.



ORDINARY FORE-SHOE (SEATED).

PLATE XII.

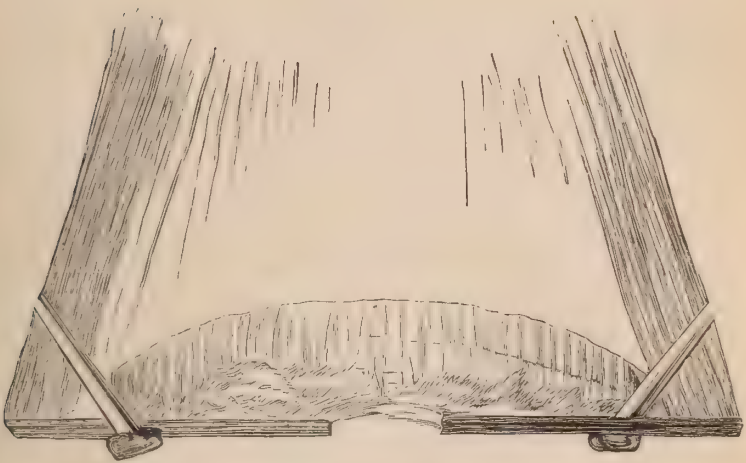


DIAGRAM OF ARAB SHOE NAILED TO FOOT.

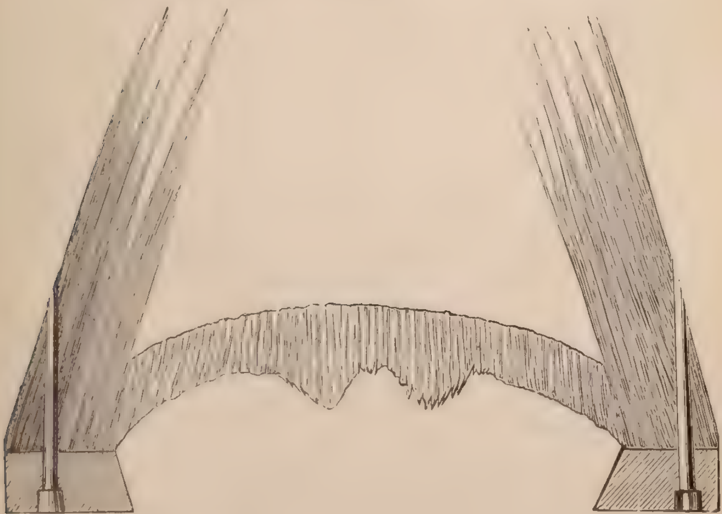


DIAGRAM OF MODERN SHOE NAILED TO FOOT.

XXXIV.—*Memorandum on the Newcastle Engine Trials.* By WM. ANDERSON, M.Inst.C.E., Consulting Engineer to the Society.

THERE are several matters connected with the engine-trials at Newcastle in July 1887, and the deductions made from them, which it will be beneficial to review.

Exception has been taken to the mode adopted, in the engineers' report, of reducing to a standard temperature and pressure the quantity of water evaporated by the boilers. It has been pointed out that instead of assuming the water to have been actually evaporated at 212°, as has been done, the larger quantity of heat at the working pressure should have been allowed for. Thus, in the case cited of engine No. 3114, the steam in the boiler was at 120 lbs. pressure, equal to 350° temperature, and each pound contained 1188·75 units of heat above the freezing point. The water was pumped in at 83·6°, or 51·6° above 32°; hence the number of units per 1 lb. of steam was 1137·1, and not 1095 as stated in the report; and the quantity of water evaporated should have been estimated at nearly 4 % higher. The correction, if made, will not sensibly affect the comparative results, and it should be understood that neither method of reduction will give even an approximation to what a boiler working at some given pressure would do if worked at that of the atmosphere. The rate of evaporation in a boiler depends not only upon the quantity of heat which has to be imparted to the contents of the boiler, but also upon the difference of temperature between the products of combustion in the furnace and flues, and the water in the boiler. The lower the pressure the greater this difference becomes; but as we have no means of measuring the mean temperature of the furnace and of the products of combustion, we cannot tell what the difference of temperature may be, and therefore one of the factors in the calculation is missing.

It is difficult also, if not impossible, to arrive at any conclusion by direct experiment, because, in boilers such as those generally used in agricultural engines and in locomotives, the mass of water and the free surface from which the steam can escape are small compared with the volume of steam generated. At high pressures these volumes are reduced in proportion to the pressure: thus at 120 lbs. per square inch each bubble of steam would be $\frac{1}{9}$ the size of the same weight of steam at atmospheric pressure. Hence ebullition in the latter case is much more violent, and the consequent priming of the boilers more severe.

In some recent experiments with an eight-horse boiler I

found that the boiler could not be worked at a lower pressure than 35 lbs. to the square inch, because water was so abundantly ejected with the steam. At 98 lbs. pressure, 5·85 lbs. of water were evaporated from 49° by 1 lb. of inferior coal, while at $35\frac{3}{4}$ lbs. pressure, 6·48 lbs. were evaporated from $47\frac{1}{2}$°, or nearly the same temperature. The units of heat imparted per 1 lb. of steam were only as 1167·5 is to 1152·3, and the evaporation at the lower pressure should only have been 5·94 lbs. of water per 1 lb. of coal, instead of the quantity given above. The excess, amounting to 9 %, was due probably to the increased difference of 55° between the temperature of the water in the boiler and the furnace, and no doubt also, to some extent, to priming.

The method of ascertaining the rate of cooling was not satisfactory. It was impossible to seal the ash-pans and the fire-box and smoke-box doors completely, so as to prevent all access of cold air to the inside of the boiler; and the conditions during cooling were not the same as when the engines were at work, for the observations commenced generally in the evening when the weather was colder, and the runs took place in a covered shed, while the cooling proceeded in the open air.

In future efficient means of closing the chimney should be provided, and the sheds should be made roomy enough to allow the engines to coal in the same place where they worked.

With respect to the general conduct of the trials, it would be well that on a future occasion there should be two weighing machines appropriated to each engine. One should be fitted with a coal-box large enough to hold the whole of the coal required for the trial run, and should be so arranged that the driver could fire direct from it; and the second machine should be fitted with a water tank capacious enough to hold the whole quantity of water likely to be used. The weight of coal and water should be taken every ten or fifteen minutes, so that the rate of consumption throughout the run might be ascertained, and all chance of error avoided. It may, indeed, be necessary in some cases—when, for example, the condensed steam from the feed heaters is returned to the feed tanks—to use two small supplementary tanks and weighing machines besides the main feed tank, in order to gauge correctly the quantity of water evaporated.

It is desirable to alter the revolution counters on the brakes, so that the figures should appear clearly on the revolving dials, in order that the number of revolutions may be easily read off while the counters are running; and this reading should be taken simultaneously with the observation on the weight of coal and water. By taking these precautions, a run will not be lost in

the event of some temporary mishap in the trial, a circumstance which often occurs.

In future, a good clock with a seconds hand should be fixed in a conspicuous position, and should be the standard of reference for time. Hitherto the watches of the Judges and engineers have been used, but considerable confusion has more than once arisen when a Judge has not been able to see a trial run through. He has had either to hand his watch over to his colleague, or to get the watch of the latter set to his own.

With respect to the employment of automatic recording instruments, about which many suggestions have been offered, I do not think that they are applicable to the wants of the Society. In the first place, the time allowed for the trials is necessarily short, and it would therefore be difficult to fix and adjust the apparatus; but the chief objection is, that it is impossible to find out from the exhibitors, in reasonable time, what their engines will be like.

Many of the engines are not even designed at the time of entry, and are not completed till a very few days before the trials; the speeds and brake horse-power are not fixed, and even such a simple matter as the indicator gear is not properly prepared. Thus at the last trial one engine had indicator cocks and pipes so small that the diagrams were worthless; in two other engines the gear had to be altered, and these same engines ran in a direction contrary to all the others, so that a spare brake, provided for such a contingency, had to be altered on the spot for their special benefit.

It might perhaps be instructive, after the competition is over, to run the prize engines a second time, and make observations which could not be undertaken during the competitive runs; but it is doubtful whether the exhibitors would like any such proceeding, as it would prevent the engines appearing at once on the stands.

There has been a good deal of controversy in the engineering papers respecting the action of the Society's brakes fitted with Appold's automatic adjusting levers.

It appears that both Mr. Appold and Mr. C. E. Amos were aware of the effect which the pull upon the upper end of the adjusting levers has on the power developed on the brake; they do not seem, however, to have attached any importance to it, or to have made any corrections in respect of such error in the trials recorded in the Journal. The late Mr. Rich, who conducted most of the brake experiments after the retirement of Mr. J. C. Amos, was well aware of the possible source of inaccuracy, but he was of opinion that it was insignificant, or,

at all events, not serious enough to affect the comparative results, which it was the main object of the trials to obtain.

The point was not lost sight of when it became necessary to decide upon the mode of conducting the Newcastle trials. It was considered important that those trials should be carried out as nearly as possible in the same manner as those at Cardiff, and with the same instruments, in order that a comparison might be made which would indicate the advantages, or otherwise, of the compound system.

It might be argued that if the sources of error were known, arrangements might have been made for measuring the pull on the ends of the adjusting levers, and obtaining in that way the means of making corrections if any were required. But any such attempt would have involved an important change in the brakes; that is to say, the points of suspension of the levers would have had to be made moveable instead of fixed, and the brakes would consequently not have been the same as those used at Cardiff. The importance of precise similarity is, in the eyes of the competitors, very great, a fact which is illustrated by the circumstance that Messrs. McLaren were not content to be tried on a brake exactly similar to that assigned to Messrs. Davey, Paxman, & Co., but they wished to be run upon the very same instrument. Had time permitted, I should certainly have preferred to run all the engines on the same brake.

The pull upon the upper ends of the adjusting levers depends upon two things: first upon the load suspended to the brake strap; and secondly upon the mode of lubrication of the strap and wheel, because upon this depends the tightness of the strap.

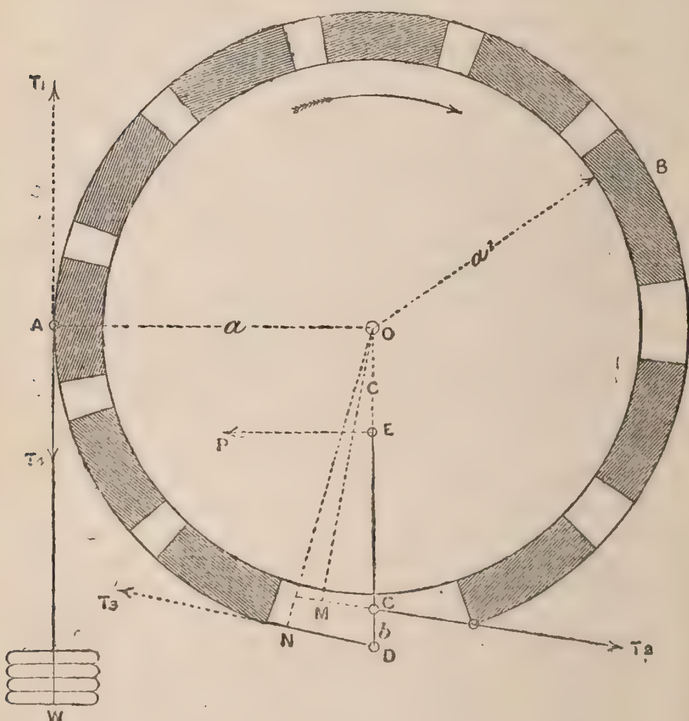
With a given weight of strap, and up to a certain tension, the amount of which depends upon the mode of lubrication, the strap does not come into actual contact with the whole circumference of the brake wheel. There is no appreciable variation of stress at the points of attachment of the brake strap to the adjusting levers, in consequence of variations in the load; the brake strap does not press against the lower half of the wheel at all, and hence the levers are inoperative, that is to say, the swing of the lower ends will not alter the tightness of the strap, and there is consequently no pressure at their fixed ends caused by the load. When the lubrication is very good and the coefficient of friction is consequently small, the brake strap has to be tighter than when the lubrication is inferior and the coefficient of friction large, and the pressure on the fixed ends of the adjusting levers increases in proportion.

As soon as the strap begins to bear all round the wheel, the

pull on the upper ends of the adjusting levers begins to increase proportionately to the load added. This pull will have the effect of reducing the amount of the load on the brake by the amount of such pull reduced, in the ratio of the distance of the fixed ends of the levers from the centre of the brake shaft to the distance of the point of suspension of the load from the same place.

I am indebted to my partner Mr. Wm. Dickinson for the following investigation into the theory of the brakes :—

Let W = Load on brake strap.
" $T_1\ T_4$ = Tensions just above and below the points of suspension of W.
" $T_2\ T_3$ = Tensions at two ends C and D of strap connected to lower ends of compensating levers.



" P = Pull on upper ends of these levers.
" a, a' = Radii of brake strap and wheel respectively.
" $O\ D = d$, $C\ D = b$, and $O\ E = c$.
" F_1 = Friction of A B C,
" F_2 = Friction of A D, and F = total friction of brake strap.

The portion A B C of the brake strap is kept in equilibrium by the

tensions T_1 and T_2 at its ends, the friction exerted on it by the wheel and by its own weight. This gives, taking moments about O—

$$T_1\,a = T_2\,OM + F_1\,a' + \text{moment of weight of } ABC.$$

Considering the portions A D in the same way,

$$T_3\,ON = T_4\,a + F_2 a' - \text{moment of weight of } AD.$$

Adding these two equations, we get

$T_1\,a + T_3\,ON = T_2\,OM + T_4\,a + (F_1 + F_2)a' +$ difference of moments of weights A B C and A D.

But the moment of weight of A B C = moment of weight of A D because the strap is accurately balanced.

$$\therefore (T_1 - T_4)\,a = T_2\,OM - T_3\,ON + F\,a'.$$

$$\text{Now } OM = OC \text{ sine } OCM = (d - b) \text{ sine } OCM$$

$$\text{and } ON = OD \text{ sine } ODN = d \text{ sine } ODN$$

$$\text{and } T_1 - T_4 = W.$$

Substituting these values in the above equation we get

$$W\,a = T_2\,(d - b) \text{ sine } OCM - T_3\,d \text{ sine } ODN + F\,a'$$

$$= d\,[T_2 \text{ sine } OCM - T_3 \text{ sine } ODN] - b\,T_2 \text{ sine } OCM + F\,a'$$

But, because the lever is in equilibrium, considering the forces at right angles to it,

$$T_2 \text{ sine } OCM = P + T_3 \text{ sine } ODN$$

$$\text{or } P = T_2 \text{ sine } OCM - T_3 \text{ sine } ODN$$

And by taking moments about D of all the forces acting on the levers,

$$DE \times P = CD \text{ sine } OCM.\,T_2$$

$$\text{or } (d - c)\,P = b\,T_2 \text{ sine } OCM.$$

Substituting these two relations in the above equation we get

$$W\,a = d\,P - (d - c)\,P + F\,a'$$

$$W\,a = c\,P + F\,a'$$

$$\text{or } W - \frac{c}{a}P = \frac{a'}{a}F.$$

That is to say, in order to get the effective value of W, the pull at E diminished in the ratio of c to a must be deducted.

This result agrees with the principle that the external forces acting on the system should balance. Since it is at rest and the tensions are internal forces, the Load, the Pull at E, and the Friction are the only external forces that have to be considered, as the point of support is in the centre of gravity of the strap.

This gives, at once, by taking moments about O

$$a\,W = c\,P + F\,a'$$

as before. Also because

$$P = \frac{b\,T_2 \text{ sine } OCM}{d - c}$$

it follows that P depends upon the tension of the strap and upon the proportion which C D bears to the whole length of the lever. Now the tension of the strap depends upon the lubrication, hence the more efficient, that is, the greater, will be the inaccuracy of the brake.

It is evident that in order to determine the probable amount of error in the Cardiff and Newcastle trials, the pull upon the upper ends of the levers must be ascertained when the brakes are running under exactly the same conditions as to power, speed, temperature of air, and lubrication. It would be impossible to secure all these conditions, and I have consequently

made no attempt to repeat the trials. I have, however, satisfied myself by experiment that when the lubrication is constant, the pull on the upper ends of the levers always bears a constant ratio to the load on the brake.

The amount of error due to the Appold arrangement is, I believe, not great for moderate powers, and Messrs. McLaren have given me the means of verifying this opinion. Feeling dissatisfied with the results obtained at Newcastle, they requested Mr. Halpin and Professor Barr to repeat the trials with their compound engine, and for this purpose they used two brakes, one designed by Mr. Halpin, and the other constructed on the same principle as those used by the Society. Messrs. Halpin and Barr's report was published in the *Engineer* of December 2, 1887, and indicates that considerable pains were taken to make the trials as accurate as possible.

The following table gives the results obtained by Messrs. McLaren, and at the Newcastle trials of the Society :—

—	Messrs. McLaren's Trial		R. A. S. E. Trial
	Halpin's Brake	Brake made like R. A. S. E.	
Indicated Horse-Power	23·7	22·2	24·02
Brake Horse-Power	20·2	19·1	20·77
Coal per Brake H.-P. per hour	2·11	2·14	2·267
Water supplied per Brake H.-P. per hour . .	22·1	22	21·53
Mechanical Efficiency	·85	·86	·86

It will be seen that the figures agree very closely: hence we are bound to assume that the experiments at Newcastle were substantially accurate, or that Messrs. Halpin and Barr have erred to the same extent as we are supposed to have done.

Nevertheless, as there is an undoubted source of error in the Society's brakes, I recommend that in future trials the Appold levers be dispensed with, or some other form of measuring instrument be adopted. Improvements in instruments devised for measuring power are going on constantly, and it would therefore be unwise to fix on any particular form till the necessity for making a selection arises.

XXXV.—IN MEMORIAM.

(a.) *The late Charles Randell.* By JOHN DENT DENT, Ribston Hall, Wetherby.

THIRTY years ago, when clay-land farmers were almost as much depressed in spirits as they have been during the last few years, I remember the late Sir Henry Meysey Thompson asking me to ride over to his farm at Kirby, to see some experiments in clay-burning which he was carrying out with labourers sent to him and advice tendered by Charles Randell of Chadbury. This was the first special notice of Mr. Randell which occurs to me, but I remember well how highly his practical knowledge was then spoken of. Some years passed by, during which I only knew him by report as a man facing the difficulty of clay-land culture with spirit and with hope, and with success as times improved.

In 1861, however, I found myself, to my great delight, elected a member of the Council of the Royal Agricultural Society, and my colleagues elected in that year were Earl Cathcart and Mr. Wells (still happily surviving), and Mr. Randell. No one could have seen Mr. Randell, then in the prime of life, without being struck with his handsome presence and his fine manly English address.[1] When I undertook the office of steward of live stock at the Show at Worcester in 1863, he gave me much help in my endeavour to put an end to certain rascalities existing amongst the exhibitors of pigs, and during the two following years we were fellow-stewards of live stock at Newcastle and at Plymouth. At this time some of the newly elected members of Council thought that there was room for considerable improvement in the management of the Society, and especially in the conduct of its Shows. Mr. Randell entered heartily into these aspirations, and it was mainly owing to his wide experience and his practical knowledge of business in every form that we may attribute any measure of success that was attained. He was very quick to see any mistakes even in matters of detail, and very ready in remedies; while his firmness and common sense always kept in check any dangerous enthusiasm of his younger colleagues.

[1] One of my colleagues writes of him, "His commanding presence and honest countenance betokened the essential qualities of the man—tender-hearted, yet determined—holding his own with every one, I thought him always most generous in the appreciation of others, and in the expression of that feeling."

From that time he took a prominent part for twenty-five years in every department of the work of the Society. In the management of its finances his sturdy sense and his practical knowledge of work of every description were invaluable. He was perhaps too strict a guardian of the funds of the Society, and we sometimes thought that he encouraged the Finance Committee to draw the purse-strings too tightly; although when he could be convinced that the money would be well spent, we had no cause to complain. He very soon acquired so great an influence in the Council that, if any new departure were suggested, it was generally considered desirable to see what Mr. Randell thought of it before bringing the matter forward for discussion.

On the question of education he and the late Mr. Holland were the most conspicuous advocates of the party which held that the Council should only deal with technical agricultural education, and not concern itself with the general education of the agricultural classes. At one time this was a much-debated question in the Council, and led to a considerable divergence of opinion, and ultimately to a compromise which has not been quite so successful in its results as we could have wished. Seeing things very clearly himself, and having great readiness and facility both in acquiring information and in imparting the results of it to others, he did not, I think, recognise that the ordinary farmer had not an equal readiness, and that in too many cases the want of sound general education prevented him from sufficiently appreciating the results which science was developing in agriculture. At a later period something of the same kind actuated Mr. Randell in regard to chemical investigation. He was so anxious to put practical results before his fellow-agriculturists, that he rather looked down on scientific investigation, and urged the Council to institute and encourage experiments which should be carried out by farmers as a part of the practice of the farm, under the belief that the results would be sufficiently accurate, and of more substantial value than those of Rothamsted and afterwards of Woburn.

In both these cases his line of conduct was the result of a mind of considerable power, which had made him active in experiment before his fellows. By an opportune accident, the other day I came across a French book published in 1855, giving an account by M. le Comte Conrad de Gourcy of his third agricultural tour in England and Scotland in 1851. Several pages are devoted to this gentleman's account of Mr. Randell and the farm at Chadbury, and he says, "any agriculturists who have some days to spend in England will do well to visit this farm,

for Mr. Randell seems to me one of the best farmers of his country." This French gentleman enters into every detail of the farm, the clay-burning, the cropping with vetches and other green food, the feeding sheep in pens on burnt clay, the ingenious hurdles for summer folding; the cross-breeding of sheep and of pigs. He specially notices the greyhounds, with which at that time Mr. Randell was so successful;[1] and concludes his remarks by saying that in all these experiments Mr. Randell, who had been blamed at first by his neighbours, now found his example very generally followed.

M. de Gourcy's description of the man seems to me to afford some insight into Mr. Randell's conduct with regard to what I may call the scientific work of the Council. He had a mind capable of planning experiments, and exhibited patience and skill in practically carrying out the same. He had himself succeeded, and he believed there were many more amongst English agriculturists who possessed an equal originality of conception and fertility of resource. He did not, therefore, think it necessary for the Royal Agricultural Society to concern itself with general education, but rather to aim at encouragement of special agricultural education, and of enforcing that teaching by experiments carried out by what he called practical men. I fear his estimate of his fellow-agriculturists was too exalted in this respect.

I have alluded at some length to this portion of Mr. Randell's work on the Council because the subjects referred to are still full of unsolved problems, and we have yet much to learn in them. Technical education in agriculture, differing opinions as to the efficacy of certain elements of manures, and other questions in relation to agricultural chemistry, are still matters for discussion; and when discussed we shall miss the powerful criticism he could bring to bear upon them.

His labours in the Showyard Contracts Committee, of which for some years he was chairman, were marked with most satisfactory results, not merely in economy to the Society, but in the improvement of every detail of the yard. He strenuously advocated a restriction of our then costly trials of field implements, and to a great extent his views were adopted—viz. that the Society should only offer prizes for new implements, or impor-

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[1] Mr. Rawlence writes to me: "I first became acquainted with Mr. Randell from meeting him at the coursing meetings on the Wiltshire Downs. I saw a great deal of him from 1845 to 1855, as he used to attend the Wiltshire coursing meetings and stay with my brother. He was as good a judge of a greyhound as he was of sheep, cattle, and horses; he bred some very good dogs, and won some big stakes."

tant modifications of those already existing. Undoubtedly the repeated trials of practically similar implements might be carried to excess, and the expense of procuring trial fields, and of making anything like exhaustive examination of the implements presented, was a matter for serious consideration; but I have never been quite able to agree to the practice of offering large sums in our prize sheets for live stock, much of which shows no improvement over the animals exhibited forty years ago, and of limiting the prizes offered for machinery, which may give such efficient aid in the production of food for the nation.

In every large society it is found necessary at times to look into questions of management and expenditure, and both in Lord Vernon's Committee of 1871 and Sir John Thorold's of last year, Mr. Randell bore a conspicuous part and made many most valuable suggestions. On questions which arose as to cattle diseases and trade in animals, in conjunction with Mr. Booth and Mr. Jacob Wilson, he collected and prepared most important information for the Society and the Government of the day; but, although quite willing to discuss such general agricultural questions as the foregoing, he opposed any alteration of those clauses of the Charter which prevent discussion in the Council of political questions or matters pending in Parliament. Experience had taught him that on a grave emergency like cattle plague the Council did exercise a discretionary power in dealing with such matters; and that the happy harmony which for fifty years had existed amongst men of widely divergent political opinions at the Council might perhaps be seriously impaired were these restrictions removed.

His high position as a farmer and a land agent made his opinion most valuable when questions arose as to the compensation to be paid under the Agricultural Holdings Acts; but he moved and carried, after some discussion, that the Council should not publish as authoritative any suggestions to valuers, although he quite approved of the issue in the Journal of the table prepared by Sir John Lawes and Dr. Gilbert on the manurial values of different kinds of food. I should make my recollections too lengthy if I were to go more into detail. Looking through the Proceedings of the Council for the last twenty-seven years, I find him taking part in every question of interest.

When our late secretary came to us, and was anxious to obtain all the information that his acquisitive mind could digest, no one helped him more than Mr. Torr and Mr. Randell, and to the day of Mr. Jenkins's death he had no kinder friend and adviser than Mr. Randell.

In the Journal for 1844 I find a letter from him to his land-

lord, Mr. Holland, giving a full account of the system of burning clay which he had adopted. This was followed by another letter to the late Mr. Thompson in 1863, giving the results of his experience. He was a very warm advocate of this practice, both as an aid to cultivation and fertility when the clay, couch, and other rubbish were burnt in small heaps and the ashes spread upon the land; and also when banks were burnt in clamps, and the burnt clay was used to bed sheep feeding in pens, and afterwards as a manure for the growth of roots.

Shropshire sheep were reported upon by him in connection with the Shows at Leeds and Bury St. Edmunds with a warm appreciation of their merits as rent-payers, and at Bury he remarks that their owners are unsparing in their efforts to excel one another in breeding, feeding, and *shearing*. At the same Show he is puzzled to find out the merits of the Suffolk sheep, and writes strongly on the necessity of the Council dealing with the shearing and trimming questions.

He was an excellent judge of most kinds of stock, and constantly in request,[1] and he set his face very determinedly both at the Council and in the Show-field against the tricks of sheep-shearing and of colouring pigs.

He was very communicative to inquirers on agricultural questions, and whether to Mr. John Algernon Clarke on steam cultivation, or to Mr. Morton seeking for information on the effects of seasons in 1868 and 1872, he was equally ready to give the result of his experience. In 1868 he finished his harvest on the last day of July, and had then only five acres of cabbage and two of mangold for 1,000 sheep; but with his usual resource he at once sowed 133 acres with mustard, rape, and turnips, and these growing rapidly in the heated soil he contrived to winter his flock.

After the passing of the Agricultural Holdings Act of 1875, he furnished for the Journal copies of agreements which he had used for some years. The object of these was to "provide for freedom as to cropping and disposal of produce, a large amount of compensation for unexhausted manures and food, and a remedy for the landlord in case of waste by enabling him to set off the penalty for default against the amount of compensation to which the tenant is entitled for hay, straw, roots, and acts of husbandry."

He did not believe in tenants laying clay land down to grass. In 1882 he writes: "Tenants know that with a return

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[1] Mr. Randell judged Shropshire sheep for the Society on no less than eight occasions, viz. in 1860, 1861, 1863, 1873, 1875, 1878, 1885, and 1887.

of better seasons all moderately good clay land will pay them better in cultivation than in grass, and will carry more stock while consuming green crops, such as vetches, clover, cabbages, rape, and mangold, alternately with wheat, barley, and beans, than it would do in permanent pasture." At the same time he recognises that landlords who have farms thrown on their hands, and have not capital with which to farm, may be compelled to lay clay land down, and he advises a course which he considers likely to answer.

In reporting on Farm Accounts, the Committee of which he was a member recommended only two simple books to be kept, "their object being to put before farmers a simple form which they can keep with the least possible trouble, and which will show what farming does for them in every year."

I must conclude these allusions to his papers in the Journal, all full of the man and his suggestive spirit, with one extract from the lessons to be learned by the wet season of 1878–79: "That even in such seasons, relying upon our own exertions and the promise that 'seedtime and harvest shall not fail,' we must determine to produce all we can, especially of such things as are least abundantly imported—mutton and malting barley, to wit—and hope that with more favourable seasons and an improvement in the general trade of the country we shall, as heretofore, get over all our difficulties."

I might make many more quotations, but I think I have given enough to show the spirit in which he thought and worked, and the ready manner in which he could record the results of his work for the information of others.

Failing health in the year 1886 made him propose to resign his seat at the Council; but His Royal Highness the Prince of Wales, as President, addressed him the following letter, which expresses admirably the feeling entertained by his colleagues:—

"February 3, 1886.

"SIR,—Your letter addressed to the Secretary of the Society, conveying your desire to resign your seat on the Council, has just been read. The Council have expressed their great sympathy with you in the circumstances which have led to your desiring to relieve yourself of some of your public engagements. At the same time they are unanimously of opinion that they cannot afford to lose the benefit of your matured advice and assistance, which have been of such signal use to the Society during a period of almost a quarter of a century. They therefore trust that you will allow your name to remain in the list of the Council, so that, although you may not feel able to attend the meetings as often as hitherto, your colleagues may still be able to consult you on important questions as they arise, in your continued capacity of a member of the Council of the Society.—I remain, Sir, yours faithfully, (Signed) "ALBERT EDWARD P., *President.*"

"Charles Randell, Esq."

In consequence of this letter he worked on to the last, and took an active part in our deliberations three short weeks before his death.

For twenty-seven years I worked with him on the Council, and took an active part sometimes in accordance and sometimes in partial disagreement with his views; and the impression left on my mind, and I believe on all who came in contact with him, is that a finer type of an intelligent English agriculturist never existed. He saw things rapidly, he felt their importance or their insignificance very strongly, he had a vigorous power of utterance of his opinions, and he never shrank from saying what he thought was right, even if the language in which he did it was at times somewhat forcible. But he was always fair, and never uncourteous, to an adversary, and his memory will be dear to his colleagues as that of an Englishman indeed!

(*b.*) *Some Late Contributors to the Journal.* By the EDITOR.

It is a noteworthy but melancholy circumstance that in the short space of six months the three leading professional writers on agricultural subjects—each an old and trusted contributor to this Journal—should have been gathered in by the Great Harvester. If those officially connected with the Society—such as the successive chairmen of the Journal Committees, the late Editor, and the late Dr. Voelcker—be left out of the account, probably no three writers have done more to advance agricultural knowledge through articles in this publication and in other ways than John Algernon Clarke, John Coleman, and John Chalmers Morton.

It is not proposed on this occasion to attempt any elaborate biography of these men, or any critical analysis of their life and works; but it has been felt by those in authority that they should not be allowed to pass away quite unrecorded in the Journal to which they devoted some of the best efforts of their brain. The present writer is indebted solely to his official position as Editor of the Journal for the privilege of writing a brief tribute to the memory of these departed worthies of the Society, and he must plead, in extenuation of any imperfections, want of personal knowledge of those whose lives he attempts to portray. As, however, this obituary notice is mainly concerned with the triad in their relations with the Journal, less disadvantage than usual will, it is hoped, arise from the circumstance that it is penned by one who had little or no personal acquaintance with them.

John Algernon Clarke,

who was the first of the three to lay down his pen, was born in the year 1828. The son of a Lincolnshire farmer, who was himself well known as an agricultural writer and as a judge in the show-yard (Mr. John Clarke of Long Sutton), his thoughts were early directed to that interesting tract of land all round him known as the Fen Country. During the first half of the Royal Agricultural Society's existence an important part of its annual programme was the giving of prizes of substantial amount for the best essays on selected subjects. For the year 1847 one of the twelve subjects for essays was "the Great Level of the Fens," and John Algernon Clarke, who could then have been only nineteen years of age, won the prize of 50*l.* with a remarkably luminous and well arranged essay, which appeared in Vol. VIII. of the Journal (1847). No doubt encouraged by his success, we find him in 1850 competing again for and winning a prize of 50*l.* on the "Farming of Lincolnshire," a subject on which he was peculiarly fitted to treat. His very elaborate prize essay on this subject takes up 155 pages of Vol. XII. of the Journal (1851), and may still be read with interest and profit.[1] A third prize of 50*l.* was granted to him in 1854 for another essay on "Trunk Drainage," which appeared in Vol. XV. (1854).

The list of essays for the year 1859 contained a reference to a subject which Mr. Clarke made his own, and to which the Society for several years devoted much time and money, viz. "the application of steam power to the cultivation of the land." Mr. Clarke won the prize of 25*l.* for the best essay on this question, and his paper appears in Vol. XX. of the Journal (1859). Four years later (in Vol. XXIV. 1863), he wrote an article on "Five Years' Progress of Steam Cultivation," in which he summed up the "mechanical improvements and practical results which since [his former paper] had made steam tillage the preeminent triumph of modern English agriculture."

At the general meeting of the Society in May 1866, the Council announced that "the application of steam to the cultivation of the soil had received their careful attention, and they considered that the time had arrived when an attempt should be made to arrive at the results which had been obtained by its use on different soils or in different localities." Accordingly, Inspection Committees were appointed to visit such farms as a

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[1] Note, for example, the use made of it by Mr. Fredk. I. Cooke, in his Report in the present number on the Farm Competition in Nottinghamshire and Lincolnshire.

special Central Committee of the Council might select for the purpose.

The second Inspection Committee consisted of Mr. Robert Leeds, Mr. John Nicholson, and Mr. Edward Wortley, with Mr. Clarke as secretary, and the area of their operations was very large, including Northumberland, York, Lincoln, Nottingham, Stafford, Salop, Kent, Montgomery, Worcester, Warwick, Gloucester, Somerset, Dorset, Wilts, Berks, Oxford, Bedford, and Northampton. In Mr. Clarke's exhaustive report, which appears with those on the same subject by Mr. Howard Reed and Mr. John Coleman in Vol. III. of the New Series (1867), the experience of 140 practical farmers on 66,000 acres is summed up, and the facts are marshalled with his customary lucidity. When the Society decided to give prizes at Wolverhampton (1871) for the best combination of machinery for the cultivation of the soil by steam power, Mr. Clarke was naturally selected as reporter; and his masterly report in Vol. VII. of the New Series, on the prolonged and expensive trials instituted by the Society, is justly described as one of the most valuable contributions ever made to the Journal.

The other papers of Mr. Clarke in the Journal included a short account of the Lois-Weedon system of wheat-growing (Vol. I. New Series, 1865); a paper urging the importance of increasing our home production of poultry (Vol. II. 1866); the official report on the trials of Reaping Machines at Leamington, in connection with the Birmingham Show of 1876 (Vol. XIII.); and—a worthy conclusion to his services to the Society—the paper on Practical Agriculture for the Memoir on the Agriculture of England and Wales, prepared for the International Congress at Paris in 1878. No one can read this paper, or indeed any of Mr. Clarke's articles, without appreciating and admiring his wonderful grasp of his subject, and the skill with which his facts and arguments are marshalled.

Not only in this Journal, however, but in other agricultura publications of the time, Mr. Clarke's busy pen was always finding employment. In the year 1857 he began to report for the *Times* the annual country meetings of the "Royal" and other Agricultural Societies, and his accounts of the successive Shows were always read with more than common interest. His great mechanical knowledge and wonderful inventive faculty gave to his descriptions and criticisms of new types of implements and agricultural machinery generally, a very special value. More recently he started in the leading paper a weekly column of notes and comments on agricultural subjects, under the heading "Crop and Stock Prospects." The *Times*, too,

employed his services as special commissioner in procuring graphic pictures of Irish life and Irish agriculture, when legislation on Irish land was attracting public attention.

Mr. Clarke was the founder and original editor of the *Chamber of Agriculture Journal*, and for twelve years, from 1867 to 1879, he also held the post of Secretary to the Central Chamber of Agriculture, where his large acquaintance with farmers in every county of England greatly aided his work. In this capacity his services proved also of value on questions relating to the prevention of Cattle Disease, and in the preparation of the exhaustive analysis of local Customs of Compensation for Unexhausted Improvements, made by a Committee of the Chambers before the passing of the Agricultural Holdings Act of 1875. For the last five years of his life, and until shortly before his death, he was the Editor of *Bell's Weekly Messenger*, the oldest of our agricultural papers.

His sudden death from an apoplectic seizure on November 17, 1887, deprived the agricultural community of a ready writer and an acute and thoughtful critic.

John Coleman

was born on July 1, 1830, and began his farming career at the age of 16 at the Royal Agricultural College, Cirencester. He was, indeed, the very first pupil that ever entered the walls of that institution. Two years later, while still a student, his uncle Mr. Robert Brown, a founder of the College, made him his agent over a very small property. His first business engagement was as estate agent at Albury Park, near Guildford, Surrey, then the property and residence of the late Mr. Henry Drummond, and now of his son-in-law, the Duke of Northumberland. Being then barely out of his teens, his farming experience was at that time comparatively small; but his capabilities were considerable, and his zeal and energy conquered all obstacles. Mr. Coleman soon made his mark in the agricultural world; and after holding several important stewardships, he became agent for the Yorkshire estates of Lord Wenlock, by whom he was much esteemed. He resided nearly twenty years on the Escrick property, which he left several years ago, after the death of the second Lord.

From 1856 to 1862 Mr. Coleman was Professor of Agriculture at the Cirencester College, and quitted that institution in company with several other professors, including the late Dr. Voelcker and Professor G. T. Brown, C.B., now head of the Agricultural Department of the Privy Council Office; but in

his later years he renewed his connection with the Royal Agricultural College as honorary professor. In 1865 he became agricultural editor to the *Field*, and from that time till a few months before his death his life was a most active one, alike as writer, journalist, and reporter, in addition to his work as private land agent, and—since leaving Escrick—in business at York as a land agent and farm valuer of great repute.

Mr. Coleman's association with this Journal commenced in the same way as Mr. Clarke's, viz. by winning one of the Society's Essay-prizes. In 1855, 40*l.* was offered for the best essay on the causes of fertility and barrenness in soils; and Mr. Coleman's succinct and valuable prize thesis on this interesting subject appeared in Vol. XVI. (1856). His next appearance in the Journal was in 1859 (Vol. XIX.), when, writing from Cirencester, where he was then installed as Professor of Agriculture, he addressed himself to the very practical question of "how the general principles of commercial accounts may be reduced to a form adapted to the general purposes of a farmer." His advice is sound and his method easily comprehensible: and it is a matter for surprise that so little improvement has been manifested in the accounts of the ordinary farmer during the 30 years that have elapsed since Mr. Coleman first called attention to the matter in these columns.

Mr. Coleman was in constant request by the Society as a Judge and Reporter in the Implement Department of its country meetings, and in all his inquiries and reports was most unsparing of himself. In 1864 he reported on the Implements exhibited at Newcastle, and particularly on the Steam Cultivation trials which were the special feature of that meeting. At Plymouth (1865), he reported on the Implement Department, and was a Judge of Mowing and Reaping Machines and Miscellaneous Implements. At Bury St. Edmunds (1867—there being no show in 1866), he reported on the Implement trials, which that year were made of peculiar importance and variety in view of the absence of cattle from the Show in consequence of the cattle plague, and he also acted as one of the Judges of Thrashing Machines. In the same volume (New Series, Vol. III.) of the Journal appears a report by his pen on the then burning question of Steam Cultivation, he being the Reporter of the Supplementary Committee, deputed by the Society to inquire into the results of Steam Cultivation in Yorkshire, Durham, Cumberland, Westmoreland, Lancaster, Salop, Nottingham, Stafford, and Leicester, as part of the general inquiry to which reference has already been made (page 686). He was a Judge of Steam Cultivators at Leicester (1868), of Plans and Models of Labourers'

Cottages at Manchester (1869), and he reported on the trials of Implements at Oxford (1870).

The Journal contains nothing else from his pen until 1873, when he undertook at short notice to write the Report on the Trials of Ploughs and Harrows at Hull. In 1874 he was a Judge of Waggons, Carts, &c., at Bedford, and in 1877 of Sheaf Binders at Liverpool. Between these two dates he had acted as chairman of the English Judges of Machinery at the Philadelphia Centennial Exhibition, and his elaborate report on the interesting exhibits of American and Canadian machinery shown there is the first paper in the Journal for 1877. At the Bristol Meeting in 1878 he was again a Judge and Reporter on the Trials of Sheaf Binders and on the Miscellaneous Implements; and in the same year he acted as one of the Judges at the Great Exhibition at Paris.

In 1879 he was appropriately selected as the Reporter on the very extensive and varied collection of Implements at the Metropolitan exhibition of the Society at Kilburn, as well as on the trials of Railway Waggons intended for the conveyance of fresh provisions. In 1881 he was Judge of and Reporter on the Miscellaneous Implements exhibited at Derby; and he fulfilled the same office at York (1883). In 1884 he varied his occupations on behalf of the Society by acting as Judge and Reporter on the Farm Prize Competition in connection with the Shrewsbury Meeting. His last appointment by the Society was as Judge of Miscellaneous Implements at Newcastle (1887). He was so ill at the time of the Show that he had abruptly to break off his work and return home; and though he managed to attend and to report upon the Society's Potato-Raising Trials at Gosforth in the following October, his health was very unsatisfactory. A malignant internal tumour, for which there was no hope of cure, at length carried him off on the 19th February of this year.

In addition to his work for this Society and for the *Field*, Mr. Coleman acted as Assistant Commissioner for the seven northern counties of York, Northumberland, Durham, Cumberland, Westmoreland, Lancaster, and Chester under the Duke of Richmond's Royal Commission on Agricultural Depression. His report on his inquiries in these counties was remarkably able, and much appreciated and cited. He also found time to bring out in 1875 a large illustrated volume on "The Cattle of Great Britain," in which he was assisted by some of the first authorities on the respective breeds. This was followed, two years later, by a similar book on sheep and pigs. His last extended literary work was in connection with the revision and

re-writing of these books, so as to bring them up to date of publication; and they were issued in 1887 in one volume, under the title of "The Cattle, Sheep, and Pigs of Great Britain." He was an influential member of the Council of the Yorkshire Agricultural Society, and was for very many years a Member of the Farmers' Club, at whose meetings he was a familiar figure.

Earl Cathcart sums up admirably the personal characteristics of Mr. Coleman in words which I am permitted to quote, and which may fitly close this brief sketch of a busy and useful life:—

"I have been associated with Mr. Coleman during many years, in many places, and late and early; in the drawing-room of the country house, in the common room of the busy inn, in the trial field, in the crowded show-yard; and always, and at all times, found him the same modest, self-possessed, agreeable, energetic, well-informed man."

John Chalmers Morton

was born on July 11, 1821, and was the son of Mr. John Morton, agent for upwards of fifty years to the Earls of Ducie upon their Gloucestershire estate. He derived his second Christian name from his mother, who was a sister of the famous Scottish divine, Dr. Chalmers; and he was educated at the Merchiston Castle School, Edinburgh, where one of his uncles was head master. During the last years of his stay at Merchiston, he attended certain of the University lectures—on chemistry, physics, natural history, and agriculture. In some reminiscences of his school life which he wrote in 1879 for the school magazine, he refers to the fact that "his subsequent life was shaped mainly by the circumstances which made him a student in the agricultural class-room of the University, under the late Professor Low."

Before he was nineteen he was summoned home to take charge, under his father, of the Whitfield Model Farm on Lord Ducie's estate. While here he was enrolled as a member of the English Agricultural Society—then recently started—on the 4th September, 1839. He was thus what may be called a "foundation" member of the Royal Agricultural Society of England when it received its Charter on March 26, 1840. In the new pride of membership, he went to the historic first Country Meeting of the Society at Oxford in 1839; and it was one of his boasts that he had been to almost every Royal Show since.[1] The present

[1] In his memoir of Sir Brandreth Gibbs in the Journal for 1885, Mr. Morton refers to the fact that he himself had attended every Show except those held in 1840, 1842, 1848, and 1854 (Vol. XXI. p. 612).

writer well remembers the cheery exultation with which Mr. Morton announced, on the occasion of one of their earliest meetings, that he had just paid his fifty-first annual subscription.

In 1843 he commenced the association with the *Agricultural Gazette* which was only to be terminated by death. It was no small compliment to a young man of twenty-three to be invited to start and direct a new paper; but Mr. Morton was equal to the occasion, and threw the whole of his great energy into developing the *Gazette* and making it the influential organ of agricultural opinion which it soon became. So devoted was he to its interests, that it is recorded of him that no less than 1,300 consecutive weekly numbers of the paper were brought out without a single break under his personal supervision. From week to week for forty-five years he handled with a masterly pen all subjects connected with agricultural progress, at the same time eliciting from the ablest of his friendly contributors the details and lessons of their practical experiences. This was the great work of his life, and nobly was it performed to the last.

His holidays were of the rarest and briefest. If he were cajoled into taking a rest from the work of his paper, he usually contrived to throw himself with even greater ardour into some new subject which he had encountered in his wanderings. His idea of resting his brain by a little harmless light literature—when he grudgingly allowed himself this relaxation—was to read several novels in the day. He was indeed a man of vehement energy, who could not exist without strenuous work.

In addition to his editorial functions, he was a constant contributor to this Journal, and he found time moreover to perform the duties of an Inspector under the Land Commissioners. In the year 1855, when he was only 32 years old, Mr. Morton brought out, with the assistance of fifty of the most eminent scientific men of the day, his valuable and complete Encyclopædia of Agriculture, which contains 2,200 double-columned pages, and is still the most complete work of the kind extant. In later life he schemed out and edited a series of seven admirable little *Handbooks of the Farm*, which were published by Messrs. Bradbury Agnew & Co. between 1881 and 1884, and discussed the Cultivation of the Farm, its Live Stock and its Cultivated Plants, Farm and Estate Equipment, the Chemistry of Agriculture, and the Processes of Animal and Vegetable Life.

Perhaps the most important extra piece of work which he ever undertook was the inquiry into the Pollution of Rivers and its remedy, for which a Royal Commission was issued in the year 1868. Mr. Morton was one of the Commissioners, his colleagues being Sir William Denison, K.C.B., and Professor

Frankland, D.C.L., F.R.S. This difficult inquiry, which lasted for six years, entailed much laborious work and careful observation, and Mr. Morton threw into it all that energy and enthusiasm for which he was so conspicuous, never resting content with information at second-hand if it was possible to obtain it by personal investigation. All the chief river basins of Great Britain were explored, the polluting matters discharged into their running waters traced, and preventive or remedial measures investigated. In the great majority of instances, and notably in the case of the sewage of towns, the most effective remedy was an agricultural one, and it was in this department of the inquiry that the profound knowledge, extensive experience, and sound sense of Mr. Morton were of the greatest value to his colleagues. All the sewage farms and sewage cleansing installations in the kingdom were visited, and the data concerning them carefully collected. He also studied in much detail the so-called preventive measures, such as the Lancashire midden, the dry earth closet, and the pail system. He drew a striking comparison between these and the water-carriage system of the disposal of excreta, and it is no exaggeration to say that the searching investigations of Mr. Morton into these rival systems placed them for the first time in their true economical and sanitary positions. His vigorous pen and incisive sentences may be traced throughout the Reports of the Commissioners; indeed the agricultural portions of those reports were virtually his work.

Mr. Morton's appearance in the Journal of the Royal Agricultural Society began even earlier than his editorship of the *Agricultural Gazette*, for we find him writing to Mr. Pusey, the then Editor, on November 18, 1840, a letter sending particulars of a crop of White or Belgian Carrots on Lord Ducie's farm at Whitfield, which was published in the second volume of the Journal. In the seventh volume (1846) appeared Mr. Morton's first article: on the Maintenance of Fertility in new Arable Land, as illustrated particularly by the occurrences at Whitfield Farm since it had been drained and broken up out of old grass land about eight years before. To Volume X. of the Journal (1849) he contributed a Prize Essay some 40 pages in length on the Means of increasing our Supplies of Animal Food. Further articles by him appeared in Volume XIX. (1858) on the Cost of Horse-power, which contained some very elaborate and valuable statistical tables, and in Volume XX. (1859) on Agricultural Maxima, in which were given details of largest yields of agricultural produce of different kinds.

In the first volume of the Second Series (1865) appeared

Mr. Morton's most valuable lecture on Agricultural Education. This was the immediate cause of the appointment by the Society of its Education Committee, which has since done such good work, and for which Mr. Morton acted as examiner from the commencement of the Society's Junior Examinations in 1874 until his death. In Volume IV. (1868) appeared a Report on Town Milk, the quality and circumstances of which at that time received much less attention than they do now. In the next volume (1869) was a Report on the Agricultural Lessons of 1868, which year was characterised by a warm spring and a hot dry summer. A further Report appeared in the tenth volume on Spring Sown Wheats in 1873, when a larger extent of wheat was sown out of the usual season than had ever before been the case in this country. In Volume XI. (1875) was a Report on Cheese-making in Home Dairies and in Factories, and in Volume XII. (1876) was a full and most interesting paper on Half-a-dozen Sewage Farms, selected as fairly representing the various soils and circumstances under which Sewage Irrigation had been adopted in various parts of the country.

Mr. Morton was the Reporter on the Dairy and Stock Farms in the Liverpool Farm Prize Competition of 1877, and the similar Competition at Preston in 1885. Both these reports are characterised by his wonderful power of observation and skill in arranging his facts. He also contributed the paper on Dairy Farming to the Memoir on the Agriculture of England and Wales prepared under the direction of the Society for the International Congress at Paris in 1878. In Volume XVI. (1880) was a very exhaustive paper from his pen summing up the experiences of the year of dismal agricultural record, 1879.

The ripe experience and powers of memory of Mr. Morton made him of late the biographer *par excellence* of his colleagues of the past. Thus he wrote in the twentieth volume of the Journal a sketch of Mr. George Turner, like himself an original Member of the Society; in Volume XXI. the biography of the late Sir Brandreth Gibbs, for more than thirty years Honorary Director of the Show-yards, which contains much interesting information about the earlier country meetings of the Society. Finally he wrote in the April number of the Journal for last year a full and sympathetic memoir of the late Secretary of the Society, Mr. Jenkins.

These brief references to his work in one publication suffice to show the broad sympathies of the man, and his keen insight into agricultural problems as they arose for discussion and settlement. Mr. Dent, who, as a former Chairman of the Journal and Education Committees of the Society and in other

ways, had been much associated with Mr. Morton, has graphically described the leading characteristics of his work in the following words:—

The services of Mr. Morton to agricultural literature must ever be appreciated by each class of those depending upon the cultivation of the soil for their support. In all times, whether of prosperity or adversity, he wrote with a spirit of the most kindly sympathy for their successes or reverses. The wide experience of his life, the genial and appreciative temper of his mind, with a substratum of humour underlying it all, made him one of the pleasantest possible of agricultural writers.

To the Meetings of our own Society, and to those of the Bath and West of England, he was a welcome visitor from the first, and though he never spared what seemed a blot in our management, he ever recognised whatever of advance was made.

On dairy questions, on stock-keeping, on effects of seasons, on use of foods, he had the means of gathering information from a host of friends, and of putting that information in a most acceptable and instructive shape.

Mr. Morton died, as probably he himself would have preferred, in harness. On Thursday, May 3 last, he had gone to his city office as usual to prepare for the next number of his paper; he had subsequently travelled to Bishop's Stortford on the business of the Land Commission; and had arrived at his Harrow home, a little over-fatigued, in the afternoon. He was persuaded to lie down for a while; but within half an hour a noise overhead startled those in the room below, and, rushing up, they found him on the floor, quite dead.

He was laid to his rest in the beautiful Harrow Churchyard on the following Wednesday (May 9), when the present writer had the privilege of representing the Society of which he had been so old and distinguished a member.

The news of Mr. Morton's decease was received in agricultural circles with the deepest sorrow and regret. It was universally felt that a great and irreparable loss had overtaken agricultural journalism and literature, and at the meeting of members of the Royal Agricultural Society held on May 22, the Chairman (Earl Cathcart) gave eloquent expression to the general sentiments. His Lordship remarked on that occasion that, "as to the magnitude of the loss which the agricultural world had experienced in the death of Mr. Morton, he could speak with feeling, as Mr. Morton had been a personal friend of his own. Mr. Morton was a man of great charm of manner, of the utmost simplicity and integrity of character, and a man with whom it was delightful to transact business." Lord Cathcart related as an instance of Mr. Morton's generosity and kindness of heart, that it was with the greatest difficulty that he could be induced to accept the usual honorarium for writing the memoir of the late Secretary, and he only did so on the

ground that it would be useful for his private charity purse, an observation which (said his Lordship) was highly characteristic of the man.

At the meeting of the Council held on June 6, Earl Cathcart moved the following resolution, which was carried unanimously:—

The Council of the Royal Agricultural Society of England receive the announcement of the death of Mr John Chalmers Morton with feelings of great regret. This feeling of regret they desire to record, and request the President, on the part of the Council, to convey to the family of a late highly-esteemed fellow-labourer the expression of their appreciation, concern, and sympathy. Mr. Morton was an original member of the Royal Agricultural Society of England, and during the whole period of its existence his busy pen has been continuously employed in furthering the best interests of scientific agriculture. Every page of his voluminous writings is indicative of the writer's character: kindly, able, and perceptive, he was, above all things, a conspicuously fair and just man.

No better epitaph than this could have been desired by Mr. Morton, and no added words could increase its value or significance.

Charles Randell.

Great as the losses to the Society and the Journal have been by the deaths of the three men whose lives have been imperfectly sketched above, an even greater loss has been suffered by the decease of one who, if not directly a contributor to the Journal, appears again and again in its pages as one of the most prominent exponents of "practice with science." The farming experiences of Charles Randell are quoted by writer after writer and in volume after volume as worthy to be studied and followed, and, in any general inquiry that was on foot, the facts which he contributed were rightly held to merit particular consideration and comment. Mr. Randell was, therefore, in the best and most useful sense of the word, a contributor to the Journal.

Happily, a far abler pen than that of the present writer gives expression in a foregoing page of this number to the magnitude of Mr. Randell's services to the Society, and all that it will be necessary to do here will be to give a few facts and dates in his life which do not come within the scope of the personal recollections so vividly sketched by Mr. Dent.

Charles Randell was born on the last day of the year 1810, and was, therefore, in his seventy-eighth year at the time of his death. At a very early age he entered the office of his uncle, Mr. Richards, a land-agent in good practice in Lincoln's Inn Fields. Mr. Richards negotiated for the father of the late

Mr. Edward Holland the purchase of the Dumbleton Estate near Evesham, and retained for himself the occupancy of one of the farms thereon, which he entrusted to the management of his youthful nephew, though he was then barely fifteen years of age. Mr. Randell resided at Dumbleton in this position from 1826 to 1836, and there, by the acquisition of actual practical knowledge, laid the foundation of his great career as an agriculturist. In the year 1836 he took the Prospect House Farm, at Bengeworth, which has in recent years been converted into market gardens, and while residing there married a daughter of the late Mr. James Ashwin, of Bretforton Manor.

In 1839 Mr. Randell took from Mr. Edward Holland, who had then for some time come into residence at Dumbleton, the farm at Chadbury, upon which he resided up to the time of his death. The farm had up to that time been divided into two holdings, comprising a large proportion of poor, cold, clay land, generally held to be of small value. Long years of neglect and slovenly management under the stress of bad times had reduced the yielding properties of the land to the lowest point. It was encumbered with a multitude of straggling hedges, containing numbers of small elm trees, and was for the most part undrained.

Directing all his great energies to the work he had taken in hand, Mr. Randell soon made a complete transformation. By burning the soil, draining, grubbing, and straightening fences, bringing into use the best appliances, improving the breeds of stock, and unceasing vigilance, Chadbury became changed from a miserable poverty-stricken place to a model farm, a pattern to the country at large, and was visited by landholders and cultivators from far and near as an example of what was possible to be achieved for agriculture by enterprise, sagacity, and skill. It is recorded in the volumes of the Journal that where Mr. Randell's predecessors kept 90 breeding ewes on the Chadbury Farms, he increased their capabilities to carrying 300, and from a growth of 150 quarters of wheat—all that could be grown in the first two years of his tenancy—his growth sprang up to an average of 1,100 quarters a year. The later years of Mr. Randell's life saw a further development of the arts of culture applied to the Chadbury Farms, for the grain crops have now for the most part been superseded by market gardens.

In conjunction with his own farming operations Mr. Randell carried on a large land-agency practice, which at one time extended to the care of 30,000 acres of land. Among the noblemen and gentlemen for whom he acted in this capacity may be named H.R.H. the Duc d'Aumale, the Marquis of

Hertford, the Earl of Harrowby, Earl Fortescue, the Earl of Wemyss, Lord Sudeley, the late Mr. Holland, and Mr. Robert Martin, and by all his employers he was regarded in the light of a true and confidential friend whom they thoroughly respected and esteemed. He was looked upon as a leading authority on all matters connected with the letting and management of land, and "Randell's agreement" has become the leading precedent of the agreements for farm letting over a very wide district. In addition to his agencies, Mr. Randell's services were continually in request as an arbitrator and valuer, and as he did all his work conscientiously and thoroughly, it may be readily understood that he led an extremely active life.

An old friend of his, who wrote the exceedingly able obituary notice of him in the *Evesham Journal* from which most of the above facts have been derived, vividly sketches his character in the following words:—

Mr. Randell had just that combination of mind and character which give a man influence among those of his fellow-men with whom he was brought into association. Terse and direct in speech, dealing only with matters which he completely understood, and perfectly sincere and straightforward in motive, he rarely failed to carry to success any proposal he favoured, while on the other hand few suggestions which encountered his opposition attained or retained vitality. The very strength of his mind and convictions occasionally gave an impression of peremptoriness to his character, and he never took much trouble to conceal the scorn with which he viewed weakness, or what he deemed to be insincerity or double-dealing.

Mr. Randell was elected a Member of this Society on February 2, 1853, and a Member of the Council on August 7, 1861, on the motion of Mr. Fisher Hobbs. On February 1, 1865, a Select Committee, consisting of Earl Cathcart, Major-General the Hon. A. N. Hood [the present Viscount Bridport], the Hon. A. Vernon [the late Lord Vernon], Mr. Fisher Hobbs, Mr. Randell and Mr. Torr, was appointed to consider the whole question of the Contract for the Show-yard.

Mr. Randell took from the first a prominent share in the deliberations of this Committee, and was elected its first Chairman when it became a Standing Committee in 1866. He held this position uninterruptedly (with the exception of the year 1870, when Lord Vernon took the chair) until 1877, when, owing to ill-health, he retired altogether, at his own special request, from the Committee, and from other Committees, such as the Stock Prizes and Implement, on which he had previously served. In 1878, however, he was re-elected a Member of the Committee, and during that year he acted as Chairman of the Finance Committee during Col. Kingscote's presidency. From 1877 to 1880, the chair of the Show-yard Contracts Committee was held by Mr. Jacob

Wilson, who retired at the beginning of 1881 to become Chairman of the Stock Prizes Committee, and to make room for Mr. Shuttleworth, on whose strong recommendation the present Superintendent of Works in the Society's Show-yard had been appointed in the previous year. On Mr. Shuttleworth's decease in January, 1883, Mr. Randell resumed the Chairmanship of the Committee, and was re-elected year after year until his death.

During last winter Mr. Randell was not particularly well, and though he attended the Committee and Council meetings in November and December, his old enemy the gout held him fast at home, much against his will, at the time of the February and March meetings. He took the greatest possible interest in the inquiry of Sir John Thorold's Committee, and was in constant correspondence with the writer on points arising out of it. Sending reluctantly back to the office the Agenda paper for the February meeting of the Show-yard Works Committee, which his gout prevented him from attending, he wrote expressing the hope that some one other than himself would be elected Chairman of the year, as he was too deaf and too unwell to regularly undertake the duties. The Committee nevertheless re-elected him as Chairman, and he was fortunately able to preside at its April meeting, when much business of a complicated nature was discussed and settled. He was present, also, at a conference of the Finance and Show-yard Works Committees held on the same day with reference to the Show-yard expenditure, and took a prominent part in its deliberations. At the May Council he was also present, and made an admirable little speech in seconding, as the oldest Member of Council, Earl Cathcart's resolution recording the grateful thanks of the Society to Her Majesty the Queen for consenting to act as its President during its 50th year of existence. At the June meeting it was generally remarked by those present that Mr. Randell seemed better in health and spirits than he had been for years. In addition to the work of his own Committee, he attended by invitation a meeting of the Education Committee, and took an active part in a prolonged discussion on a particular point in which he had greatly interested himself. He spoke several times at the Council meeting, and the writer had a long and most instructive conversation with him after the Council rose, in which he displayed all his old vigour.

A few days later, however, he was seized with faintness at his home at Chadbury. Everything possible was done, but he never rose again from his bed; and early on Saturday morning, June 23, his sorrowing friends in London learnt that he was no more.

At the meeting of Council held on the following Wednesday, June 27, the President (Sir Matthew Ridley), before proceeding to the ordinary business, made a feeling allusion to the magnitude of the loss which the Council had sustained, and expressed his extreme regret that previous important engagements would prevent his personal attendance at the funeral to pay a last mark of respect to their late friend. The following resolution was then moved by Colonel Kingscote, the Chairman of the Finance Committee, and was carried unanimously, after sympathetic remarks by Mr. Dent, the Earl of Coventry, and Earl Cathcart:—

The Council desire to place on record their sense of the great loss which they have sustained by the death of their valued friend and colleague, Mr. Charles Randell. For twenty-seven years Mr. Randell has rendered invaluable services to the Council and its various committees, of many of which he was an active member; and his kindly presence, wise counsel, and indefatigable energy will ever be remembered with grateful affection by his colleagues.

They request the President to communicate this expression of their feelings to Mr. Randell's family, and to assure them of the deep sympathy felt with them in their bereavement by this Council and by all the members of the Society.

The funeral took place on the following day at Bretforton Churchyard, the body being carried to the grave by the loving hands of Mr. Randell's workmen, from one of the rooms in the picturesque Bretforton Manor, where he had in early life won his bride. He was laid to his last rest amidst the tears of his friends and neighbours, and by the side of the wife whom he had loved so well. Amongst those who travelled down from London to attend the funeral were his devoted friends Jacob Wilson and C. W. Tindall, and Mr. G. Mander Allender, a Member of the Council, the Society being officially represented on the sad occasion by the present writer.

It was a typical ending to a noble life well spent, and the closing scene—so calm, so peaceful, so beautiful—will not easily be effaced from the memory of those who were privileged to be present.

Royal Agricultural Society of England.

1888–9.

President.

HER MOST GRACIOUS MAJESTY THE QUEEN.

Year when elected.

Trustees.

1879 H.R.H. THE PRINCE OF WALES, K.G., *Marlborough House, Pall Mall.*
1855 ACLAND, Sir THOMAS DYKE, Bart., *Killerton, Exeter, Devonshire.*
1857 BRIDPORT, General Viscount, K.C.B., *Cricket St. Thomas, Chard, Somersetshire.*
1861 CATHCART, Earl, *Thornton-le-Street, Thirsk, Yorkshire.*
1861 DENT, JOHN DENT, *Ribston Hall, Wetherby, Yorkshire.*
1871 EGERTON OF TATTON, Lord, *Tatton Park, Knutsford, Cheshire.*
1863 KINGSCOTE, Col., C.B., *Kingscote, Wotton-under-Edge, Gloucestershire.*
1868 LICHFIELD, Earl of, *Shugborough, Staffordshire.*
1854 MACDONALD, Sir ARCHIBALD KEPPEL, Bart., *Woolmer Lodge, Liphook, Hants.*
1839 PORTMAN, Viscount, *Bryanston, Blandford, Dorset.*
1856 POWIS, Earl of, *Powis Castle, Welshpool, Montgomeryshire.*
1861 WELLS, WILLIAM, *Holmewood (Huntingdonshire), Peterborough.*

Vice-Presidents.

1873 BEDFORD, Duke of, K.G., *Woburn Abbey, Bedfordshire.*
1867 DEVONSHIRE, Duke of, K.G., *Holker Hall, Lancashire.*
1847 EVERSLEY, Viscount, G.C.B., *Heckfield Place, Winchfield, Hants.*
1876 FEVERSHAM, Earl of, *Duncombe Park, Helmsley, Yorkshire.*
1858 LATHOM, Earl of, *Lathom Hall, Ormskirk, Lancashire.*
1872 LAWES, Sir JOHN BENNET, Bart., *Rothamsted, St. Albans, Herts.*
1865 LOPES, Sir MASSEY, Bart., *Maristow, Roborough, Devon.*
1867 RAVENSWORTH, Earl of, *Ravensworth Castle, Gateshead, Durham.*
1852 RICHMOND AND GORDON, Duke of, K.G., *Goodwood, Chichester, Sussex.*
1869 RIDLEY, Sir M. W., Bart., M.P., *Blagdon, Cramlington, Northumberland.*
1874 SPENCER, Earl, K.G., *Althorp, Northamptonshire.*
1871 WAKEFIELD, WILLIAM H., *Sedgwick, Kendal, Westmoreland.*

Other Members of Council.

1881 ALLENDER, G. MANDER, 31 *St. Petersburgh Place, Bayswater, Middlesex.*
1877 ARKWRIGHT, J. HUNGERFORD, *Hampton Court, Leominster, Herefordshire.*
1880 ASHWORTH, ALFRED, *Tabley Grange, Knutsford, Cheshire.*
1875 AYLMER, HUGH, *West Dereham, Stoke Ferry, Norfolk.*
1871 BOWEN-JONES, J., *Ensdon House, Montford Bridge, Salop.*
1886 CAIRD, JAMES A., [illegible]
1874 CHANDOS-[illegible], *[illegible]shire.*
1884 CHAPLIN, Rt. Hon. HENRY, M.P., *Blankney Hall, [illegible].*
1883 CLAY, CHARLES, [illegible]
1883 COKE, Hon. EDWARD K. W., *Longford Hall, Derbyshire.*
1865 COVENTRY, Earl of, *Croome Court, Severn Stoke, Worcestershire.*
1887 CRUTCHLEY, PERCY E., *Sunninghill Park, Berkshire.*
1888 DARBY, ALFRED, *Littlecote, Shrewsbury, Shropshire.*
1886 DE LAUNE, C. DE L. [illegible], *[illegible] Court, [illegible], Kent.*

Year when elected.	
1882	EMLYN, Viscount, *Golden Grove, Carmarthen, S. Wales.*
1879	FOSTER, SAMUEL P., *Killhow, Carlisle, Cumberland.*
1875	FRANKISH, WILLIAM, *Limber Magna, Ulceby, Lincolnshire.*
1881	GILBEY, WALTER, *Elsenham Hall, Essex.*
1879	GORRINGE, HUGH, *Kingston-by-Sea, Brighton, Sussex.*
1879	GRENVILLE, R. NEVILLE, *Glastonbury, Somersetshire.*
1874	HEMSLEY, JOHN, *Shelton, Newark, Notts.*
1876	HOWARD, CHARLES, *Biddenham, Bedford.*
1878	HOWARD, JAMES, *Clapham Park, Bedfordshire.*
1883	JERSEY, Earl of, *Middleton Park, Bicester, Oxfordshire.*
1869	LEEDS, ROBERT, *Keswick Old Hall, Norwich.*
1881	LITTLE, HERBERT J., *Coldham Hall, Wisbech, Cambridgeshire.*
1885	LLOYD, ARTHUR P., *Leaton Knolls, Shropshire.*
1886	MAINWARING, C. S., *Galltfaenan, Trefnant R.S.O., North Wales.*
1874	MARTIN, JOSEPH, *Highfield House, Littleport, Isle of Ely, Cambs.*
1884	MILLER, T. HORROCKS, *Singleton Park, Poulton-le-Fylde, Lancashire.*
1880	MORETON, Lord, *Tortworth Court, Falfield, R.S.O. Gloucestershire.*
1886	MUNTZ, PHILIP ALBERT, M.P., *Dunsmore, Rugby, Warwickshire.*
1881	PARKER, Hon. CECIL T., *Eccleston, Chester.*
1886	PELL, ALBERT, *Hazelbeach, Northampton.*
1888	PORTLAND, Duke of, *Welbeck Abbey, Worksop, Notts.*
1886	RANSOME, J. E., *Holme Wood, Ipswich, Suffolk.*
1871	RAWLENCE, JAMES, *Bulbridge, Wilton, Salisbury, Wilts.*
1875	RUSSELL, ROBERT, *Horton Court Lodge, Dartford, Kent.*
1874	SANDAY, GEORGE H., *Langdale Lodge, Clapham Park.*
1886	SCARTH, W. T., *Keverstone, Darlington.*
1878	SHERATON, WILLIAM, *Broome House, Ellesmere, Salop.*
1886	SMITH, ALFRED J., *Rendlesham, Woodbridge, Suffolk.*
1882	STAFFORD, Marquis of, *Trentham Hall, Stoke-upon-Trent, Staffs.*
1875	STRATTON, RICHARD, *The Duffryn, Newport, Monmouthshire.*
1883	SUTTON, MARTIN J., *Dyson's Wood, Kidmore, Reading, Berkshire.*
1881	THOROLD, Sir JOHN H., Bart., *Syston Park, Grantham, Lincolnshire.*
1882	WARREN, REGINALD AUGUSTUS, *Preston Place, Worthing, Sussex.*
1870	WHITEHEAD, CHARLES, *Barming House, Maidstone, Kent.*
1865	WILSON, JACOB, *Chillingham Barns, Belford, Northumberland.*

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SHERATON, W.
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*** The PRESIDENT, TRUSTEES, and VICE-PRESIDENTS are Members *ex officio* of all Committees.

Royal Agricultural Society of England.

GENERAL MEETING.

12 HANOVER SQUARE, TUESDAY, MAY 22, 1888.

REPORT OF THE COUNCIL.

THE Council have to report the following changes in the list of Members of the Society during the year which has elapsed since the last Annual Meeting in May, 1887: 393 New Members have been elected, whilst 4 Governors and 252 Members have resigned, 7 Governors and 133 Members have died, and 90 Members have been removed from the list by order of the Council.

2. The Society now consists of:—

66 Life Governors,
56 Annual Governors,
3,521 Life Members,
5,225 Annual Members,
16 Honorary Members,

making a total of 8,884, and showing a decrease of 98 Members since this time last year.

3. Since the General Meeting held last December, the following changes have taken place in the Council: Earl Cathcart has been elected a Trustee in the room of the late Duke of Rutland, and the Earl of Feversham a Vice-President in the room of Earl Cathcart. The vacancy thus caused in the Council has not yet been filled up, but is now under consideration. The Duke of Portland has been elected a Member of Council in the room of Mr. Joseph Druce, who has retired on account of ill-health.

4. The accounts for the year 1887 have been examined and certified by the auditors and accountants of the Society, and have been published in the current number of the Journal, together with the statement of Receipts and Expenditure relating to the Newcastle Meeting. The funded property of the Society is now 25,885*l.* 4*s.* 2*d.*, while the balance of the current account in the hands of the Society's Bankers on the 1st instant was 5,691*l.* 19*s.* 9*d.*

5. The Special Committee of the Council, which, as stated in the Report to the December meeting, has been engaged in an examination of the expenditure of the Society, has now completed its labours. The field of the Society's operations is very wide, and has been increased from time to time as new opportunities for useful action have arisen. The expenditure has inevitably increased in proportion; but all the items of it have been passed in review, and the Council have every reason to expect that important economies will be effected in the future by the adoption of the Committee's suggestions.

6. As the expenditure in connection with the annual Country Meetings is the most serious item in the Society's accounts, the special attention of the Committee has been given to this subject. Various recommendations have been made, to many of which the Council have already given effect, but the Committee have been unable to suggest any substantial reductions that can be effected without interfering with the success and popularity of the Meeting. It will be interesting to the Members to learn that the saving in the cost of erection of the Showyard under the supervision of the Society's own Surveyor, as against the superseded contract system, amounts to no less a sum than 2,237*l.* per annum on the average of the last seven years.

7. One of the functions of the Special Committee was to report on the desirableness of reducing "the charges made to Members for the entry of stock and implements, and for their chemical and botanical privileges." Upon the recommendation of the Committee, the Council assented in December last to reductions in the charges made to exhibitors for implement shedding and for entries in the Implement Catalogue, and these reductions were made applicable to the Country Meeting this

year. More recently, the Council have decided to reduce from 5*s.* to 1*s.* the botanical fee for the examination of grass and other seeds, for the determination of the species of any weed or plant, or for a report on any disease affecting farm crops, and the fee for determination of a collection of natural grasses from 10*s.* to 5*s.* The Council trust that these reductions in the fees will greatly benefit Members, and will tend to check the sale of valueless seeds.

8. Amongst other recommendations of the Special Committee is one for the reduction of the money qualification of Governors from 5*l.* to 2*l.* per annum, with a corresponding diminution in the life composition. As this proposal will involve an alteration of the present Bye-Laws, which are also affected by various other recommendations of the Committee, a Special Committee has been appointed to revise the Bye-Laws throughout.

9. The Exhibition of Thoroughbred Stallions, competing for the Society's five Premiums of 200*l.* each and a Gold Medal, took place at Nottingham on the 9th and 10th February. The Competition for the 22 Queen's Premiums of 200*l.* each, offered through the Royal Commission on Horse Breeding, was held at the same time and place, and there were altogether 105 Stallions entered in the several classes for the 27 Premiums. For the five Premiums offered by the Society 24 horses were entered, and the following Stallions were selected by the Judges, the districts to which they were allocated being balloted for under the direction of the President on the second day of the Show:—

JACK TAR . . .	District of Northampton.
LANCASTRIAN . .	District of Derby.
SILVER CROWN .	District of Nottingham.
KHAMSEEN . . .	District of Melton Mowbray.
TIBER	District of Lincoln.

Satisfactory reports have been received from the local Committees as to the manner in which the nominations of mares to these stallions have been taken up.

10. The Country Meeting at Nottingham will commence on Monday morning, July 9, and close on the following Friday evening; but the Implement portion of the Show and the

Working Dairy will be open to Members of the Society and the public on Saturday, July 7.

11. The last date of entry for Live Stock and Dairy Produce is May 12, but post entries, at double fees, will be received up to June 1. The last date of entry for Poultry is also June 1.

12. The Butter-making and Horse-shoeing Competitions will be interesting features of the Nottingham Meeting. The Competition of Butter-makers will commence on Tuesday, July 10, and will continue until the last day of the Show. Candidates will be divided into three classes, viz. Members of a Farmer's family, male hired servants, and female hired servants. In each class three Prizes will be given, of the respective value of 5*l.*, 3*l.*, and 2*l.* The winners in these classes will compete on Friday, July 13, for Champion Prizes, the Society's Silver Medal being awarded to the competitor who is adjudged first, and its Bronze Medal to the competitors placed second and third.

13. The Horse-shoeing Competition will take place on Tuesday, July 10, for hunters, and Thursday, July 12, for agricultural horses. Five Prizes will be given in each class, to which the Lincolnshire Agricultural Society will add further amounts for smiths from the county of Lincoln who may be successful in winning the Society's Prizes.

14. The Council regret that there have been no entries for the Prize of 25*l.* offered by them for the best apparatus suitable for condensing milk on a farm. On the other hand, there have been forty-three entries for the Prizes offered for Hay and Straw Presses, to the amount of which the Council added in March last a further Prize of 20*l.*, for a press for old hay worked by hand-power.

15. The Council have the utmost gratification in reporting to the General Meeting that Her Majesty the Queen has been graciously pleased to signify Her Majesty's acceptance of the office of President of the Society during its forthcoming Jubilee year. His Royal Highness the Prince of Wales, to whom the Society is already so greatly beholden, has intimated his willingness to undertake on Her Majesty's behalf the more immediate duties of the Presidential office.

16. An excellent site for the Country Meeting of 1889 has been selected in the portion of Windsor Great Park known as the Cavalry exercising ground, which site, with Her Majesty's gracious permission, has been placed by the Commissioner of Woods and Forests at the disposal of the Society. The Corporation of Windsor have executed the Society's customary agreement, and enter with enthusiasm upon the furtherance of the undertaking.

17. Under these auspicious circumstances of happy augury, the Council have every reason to anticipate a satisfactory and successful Jubilee meeting.

18. The Council have resolved that the Country Meeting of 1890 shall be held in District D, comprising Berkshire, Cornwall, Devonshire, Dorsetshire, Hampshire, Kent, Somersetshire, Surrey, Sussex, and Wiltshire.

19. It has been decided that the Prizes for Cheese in 1889 shall be for Cheddar, Cheshire, and Stilton made in 1888, and any British cheeses made in 1889.

20. The Council have renewed the annual grant of 200*l.* made by them to the Royal Veterinary College in aid of the further development of cattle pathology. The Principal of the College has reported that, in order to carry out the wishes of the Council, it is important that members of the Society should send to the College any diseased animals (cattle, sheep, or swine) which they would otherwise destroy as useless, and also any specimens of diseased parts of an unusual character. The expense of transit will be defrayed by the College, and, in the event of living animals being sent, it will be necessary to telegraph to the Royal Veterinary College, Camden Town, the time of their arrival at a London station, so that a van may be sent to meet them. The Council hope that members of the Society will co-operate with the authorities of the College by assisting in the manner suggested towards a better knowledge of the diseases of animals of the farm other than the horse.

21. The Examiners of the Royal College of Veterinary Surgeons have reported that the two students from the Royal Veterinary College who passed best in the subject of the Pathology of Cattle, Sheep, and Pigs at the recent Diploma

Examinations, and who therefore became entitled to the Society's Medals, were :—

Mr. J. A. W. Dollar, M.R.C.V.S., 56 New Bond Street, W. (Silver Medal).

Mr. E. R. McHugh, Strokestown, Ireland (Bronze Medal).

22. In their last Report the Council announced that a deputation had been appointed to urge upon the Lord President the adoption of more stringent measures for the suppression of pleuro-pneumonia both in this country and in Ireland. Deputations from this and other Agricultural Societies waited upon the Chancellor of the Duchy of Lancaster at the Privy Council Office on December 9, and on March 6 last an Order of Council was issued requiring Local Authorities in England and Wales and Scotland to cause all cattle, being or having been in contact with cattle affected with pleuro-pneumonia, to be slaughtered within ten days after the fact of their having been so in contact has been ascertained, and to pay compensation for cattle so slaughtered out of the local rate. A similar Order was passed by the Irish Privy Council on the same day with regard to Ireland. The Council trust that these Orders may have the desired effect of stamping pleuro-pneumonia out of the Kingdom.

23. The Council have for some time had under their anxious consideration the difficulties experienced by Stock-owners and Veterinary Surgeons with reference to the protective inoculation of animals of the farm against anthrax and other contagious diseases, owing to the interpretation placed by the Home Office upon the Cruelty to Animals Act of 1876. Considering it highly necessary that an Act should be passed exempting Veterinary Surgeons from the provisions of this Act, when there is a *bonâ fide* intention of doing good to the animals and preventing suffering, the Council invited the authorities of the Royal Veterinary College to join with them in appointing a deputation to wait upon the Lord President to urge the importance of such a Bill being introduced by the Government. A Joint Deputation from the two bodies was received on April 24 by the Lord President, who was accompanied by the Home Secretary. Although no hope was held out to the Deputation

that immediate legislation could be attempted, the Council trust that means will be found for relieving Stock-owners and Veterinary Surgeons from their present difficulties in the matter.

24. The Council have appointed Mr. Frederick Low, of Norwich, Mr. John E. Peele, of Durham, and Mr. J. P. S. Walker, of Oxford, as Provincial Veterinary Surgeons for Norfolk, Durham, and South Oxfordshire, respectively.

25. In the last Quarterly Report of the Chemical Committee attention is called to the practice of using the term 'oil-cake' as a designation for cakes which, previous to the passing of the Merchandise Marks Act, were sold as 'pure linseed-cakes.' Intending purchasers of linseed-cake are advised, therefore, not to accept the term 'oil-cake' as a satisfactory description, but to insist on having the words 'linseed-cake' inserted on the invoices, as well as obtaining a guarantee of purity. The Council trust that their efforts to secure the greater purity of foodstuffs and manures, through the publication of cases of adulteration brought to the notice of the Chemical Committee, will receive the active sympathy and support of the Members generally.

26. There has been a considerable increase of work in connection with the Entomological Section of the Seeds and Plant Diseases Committee, owing chiefly to the great number of applications for information concerning injuries caused to the stems of corn-plants by the Hessian Fly, *Chlorops*, and the Corn Saw Fly, as well as for methods of prevention against the attacks of the Ox Warble Fly. Much attention has been given to the effect of eelworms, *Anguillulidæ*, upon clover and other crops, to the migration of the Hop aphis from hop plants to plum-trees, and to the unusual amount of harm caused to peas and beans by weevils, *Bruchi*.

27. In the Botanical Section the number of samples submitted to the Consulting Botanist has been equal to the average. It may be stated generally that the quality of the seeds continues to improve. The seeds have been true to their kind and remarkably free from weeds, though the germination has been somewhat lower than usual. Dodder has been met with in several clovers. No sample of Fiorin has been free from Ergot. The Council have already referred to the recent reduction, from

5*s*. to 1*s*. per sample, made in the fees payable to the Consulting Botanist for the determination of seeds.

28. Twenty-four candidates have entered for the Senior Examination, to be held in the Society's house on Tuesday, May 8, and four following days. This entry is the largest in any year since the establishment of the examination in 1868, with one exception, viz. 1883, when twenty-six candidates entered.[1]

29. The Council have approved New Regulations for the Junior Examinations, which have been drawn up so as to make Agriculture the dominant subject, and to prevent a candidate receiving more than one scholarship. The revised Regulations are printed for general information in the current number of the Journal.

30. The alterations in the Society's house are now complete. The library has been reclassified and rearranged, and is now available for the use of Members. In order to enable members of the Society to complete their sets of the Journal, and to purchase at a reduced price the numbers issued in years before they were elected, the Council have resolved that Governors and Members may, for a limited period, have the privilege of purchasing any of the back numbers of the Journal at three shillings per copy, *i.e.* half the present publishing price; or if not less than twelve numbers are purchased at the same time, at two shillings per copy.

By order of the Council,

ERNEST CLARKE,

Secretary.

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[1] The results of this examination were announced at the meeting of Council on the 6th June, 1888. The following three candidates, placed in order of merit, were granted first-class certificates and the life membership of the Society, besides qualifying for the prizes stated below :—(1.) William Somerville, Prize of 25*l*. (2.) Devendra Nath Mookerji, Prize of 15*l*. (3.) Syad Mohammad Hádi, Prize of 10*l*. In addition to the above, a second class certificate was awarded to Walter Frank Perkins; and special certificates (entitling to the life membership of the Society) to John Bardgett, Ernest Emilius Bennett, Henry James Colbourn, and Alfred Henry Inman.—[ED.]

Minutes of Proceedings

AT THE

ANNUAL GENERAL MEETING

OF

GOVERNORS AND MEMBERS,

TUESDAY, MAY 22, 1888,

EARL CATHCART (TRUSTEE) IN THE CHAIR.

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1. The Trustees and Vice-Presidents, together with the 25 retiring Members of Council, were re-elected.

2. The following Resolution was put from the Chair and carried unanimously :—

> *The Royal Agricultural Society of England, in general meeting assembled, receive with gratitude and high appreciation the announcement that, during the Society's coming Jubilee year, Her Majesty the Queen has been most graciously pleased to accept the office of President of the Society. The report of the Council conveying Her Majesty's most gracious condescension in this matter is hereby received and adopted, and this resolution recorded as carried by acclamation.*

3. The Report of the Council was received and adopted, on the motion of Mr. H. W. Woolff, seconded by Mr. Fredk. King.

4. Various suggestions made by Members were referred to the Council for consideration.

5. A vote of thanks to the Chairman was unanimously passed, on the motion of Surgeon-General Ince, seconded by Mr. Yates Freebody.

DR. HALF-YEARLY CASH ACCOUNT

	£	s.	d.	£	s.	d.	£	s.	d.
To Balance in hand, 1st January, 1888 :—									
Secretary				. .			5	2	4
To Income :—									
Dividends on Stock				376	19	1			
Interest on Deposit				4	3	9			
Subscriptions :—									
Governor's Life-Composition	40	0	0						
Governors' Annual	260	0	0						
Members' Life-Compositions	753	0	0						
Members' Annual	4,217	10	0						
				5,270	10	0			
Establishment :—									
Rent				210	0	0			
Journal :—									
Sales	180	7	5						
Advertisements	134	15	3						
				315	2	8			
Chemical :—									
Laboratory Fees				514	8	6			
Education :—									
Sale of Insect Diagrams				5	18	9			
Sundries				27	13	3			
Newcastle Meeting				37	5	4			
Col. Picton Turbervill's Prize				25	0	0			
Stallion Show (1887)				250	0	0			
Stallion Show (1888)				1,650	12	4			
Nottingham Meeting				7,132	4	8			
							15,819	18	4
							15,825	0	8

QUILTER, WELTON, & CO., *Accountants.*

SOCIETY OF ENGLAND.

FROM 1st January to 30th June, 1888. Cr.

	£	s.	d.	£	s.	d.	£	s.	d.
By Balance due to Bankers, 1st January, 1888 . . .				.	.		192	4	1
By Expenditure :—									
Establishment :—									
Salaries, Wages, &c.	848	15	0						
House :—Rent, Taxes, Alterations, &c.	685	8	6						
Office :—Printing, Postage, Stationery, &c..	533	12	7	2,067	16	1			
Journal :—									
Printing and Stitching	412	14	3						
Printing Advertisements . . .	20	18	9						
Postage and Delivery.	178	17	11						
Literary Contributions	206	7	0						
Prize Essay	25	0	0						
Balance of a/c previous Journals .	60	9	8	904	7	7			
Chemical :—									
Salaries	453	15	0						
Apparatus and Chemicals . . .	36	3	10						
Printing	6	1	6						
Petty Payments.	25	0	0	521	0	4			
Veterinary :—									
Grant to Royal Veterinary College				100	0	0			
Seeds and Plants Diseases :—									
Consulting Entomologist's Salary	50	0	0						
Consulting Botanist's Salary . .	75	0	0	125	0	0			
Education :—									
Prizes	50	0	0						
Fees to Examiners.	39	18	0						
Insect Diagrams	4	10	0	94	8	0			
Subscriptions paid in error returned				7	0	0			
Country Meeting Plant				23	2	0			
Newcastle Meeting				64	12	11			
Stallion Show (1888)				1,662	7	6			
Nottingham Meeting				5,303	19	7	10,873	14	0
By Balance in hand, 30th June :—									
Bankers				4,692	18	7			
Secretary				66	4	0	4,759	2	7
							15,825	0	8

Examined, audited, and found correct, this 10th day of September, 1888.

FRANCIS SHERBORN,
A. H. JOHNSON,
C. GAY ROBERTS,
} *Auditors on behalf of the Society.*

NOTTINGHAM MEETING.

1888.

STEWARDS OF DEPARTMENTS.

Implements.

J. HEMSLEY.
S. P. FOSTER.
HUGH GORRINGE.

Live Stock.

VISCOUNT EMLYN.
W. H. WAKEFIELD.
T. H. MILLER.
LORD MORETON.

Dairying and Poultry.

SIR JOHN H. THOROLD, BART.

Horse-shoeing.

CHARLES CLAY.

Forage.

WILLIAM WRIGHT.

Finance.

WILLIAM FRANKISH. | G. H. SANDAY.

Honorary Director.

JACOB WILSON.

JUDGES OF IMPLEMENTS.

Hay and Straw Presses.

DANIEL PIDGEON, Holmwood, Putney Hill, S.W.
WILLIAM SCOTSON, Rose Lane, Mossley Hill, Liverpool.
T. H. THURSFIELD, Barrow, Broseley, Shropshire.

Miscellaneous.

THOMAS BELL, Hedley Hall, Marley Hill, Gateshead.
J. W. KIMBER, Fyfield Wick, Abingdon.
DANIEL PIDGEON, Holmwood, Putney Hill, S.W.

JUDGES OF STOCK.

HORSES.

Shire.—Classes 1-4, 15-17, 26-28.

WILLIAM JONAS, Heydon Bury, Royston, Herts.
JOHN WILLS, Pengelleys, Exeter.

Clydesdale.—Classes 5–7, 18, 29–31.

W. S. PARK, Hatton, Bishopton, N.B.
ROBERT RENWICK, Dalmuir Farm, Dalmuir, Glasgow.

Suffolk Horses.—Classes 8, 9, 19, 32, 33.

A. W. CRISP, Hill House, Orford, Wickham Market.
JOHN MAYHEW, Honington Lodge, Bury St. Edmunds.

Thoroughbreds and Hunters.—Classes 10, 20, 21, 34–42.

Col. RIVERS BULKELEY, Oak Cottage, Whitchurch, Salop.
EARL OF COVENTRY, Croome Court, Severn Stoke, Worcestershire.
PHILIP ALBERT MUNTZ, M.P., Dunsmore, Rugby.

Coaching or Cleveland and Harness Horses.—Classes 11, 22, 47–49.

JAMES HORNSBY, Stapleford Hall, Melton Mowbray.
ROMER WILLIAMS, 19, Great Cumberland Place, Hyde Park, W.

Hackneys and Ponies.—Classes 12, 14, 23–25, 43–46.

ALFRED ASHWORTH, Tabley Grange, Knutsford.
Major R. H. BORROWES, Gilltown, Newbridge, Ireland.

CATTLE.

Shorthorn.

THE EARL OF BECTIVE, M.P., Underley Hall, Kirkby Lonsdale.
J. W. CRUICKSHANK, Elrick, Summerhill, Aberdeen.
JAMES HOW, Broughton, Huntingdon.

Hereford and Welsh.

SAMUEL GOODE, Montpellier House, Bodenham Road, Hereford.
JOHN CRANE, Benthall, Shrewsbury.

Devon and Red Polled.

TOM BROWN, Marham Hall, Downham Market, Norfolk.
S. P. NEWBERY, Plympton St. Mary, Devon.

Sussex Cattle.

ALFRED HEASMAN, Court Wick, Littlehampton.
EDWARD VICKRESS, Newbridge, Billingshurst, R.S.O.

Jersey.

THOMAS FALLA, Junr., Les Buttes, St. John's, Jersey.
WALTER GILBEY, Elsenham Hall, Essex.

Guernsey.

REV. J. G. S. NICHOL, North Litchfield Rectory, Whitchurch, Hants.
G. N. WYATT, Lake House, Cheltenham.

Dairy.—Classes 98 and 99.

THOMAS CARRICK, Low Row, near Carlisle.

SHEEP.

Leicester, Cotswold, and Lincoln.

J. P. CLARK, North Ferriby, Brough, Yorkshire.
WILLIAM T. GARNE, Aldworth, Northleach.
H. MACKINDER, Langton Grange, Spilsby.

Border Leicester and Other Longwoolled.

JOHN DAVISON, Tritlington Hall, Morpeth.
GEORGE REA, Middleton House, Alnwick.

Oxfordshire Down.

W. D. LITTLE, Middleton Stoney, Bicester.
NATHANIEL STILGOE, The Green, Adderbury, Banbury.

Shropshire.

PETER EVERALL, Ryton Grove, Dorrington, Shrewsbury.
J. E. FARMER, Felton, Ludlow.

Southdown.

MANFRED BIDDELL, Playford, Ipswich.
THOMAS FULCHER, Elmham, Dereham, Norfolk.

Hampshire, Suffolk, and other Short-woolled.

FRANCIS P. BROWN, Compton, Newbury, Berks.

GEORGE KING, Abington Park, Great Chesterford, Essex.

Lincolnshire Wool.

J. W. TURNER, 126, Swan Arcade, Bradford.

PIGS.

White.

GEORGE MANGLES, Great Givendale, Borobridge, Yorkshire.

WILLIAM TAIT, The Prince Consort's Shaw Farm, Windsor.

Black.

HEBER HUMFREY, Shippon, Abingdon, Berkshire.

JOSEPH SMITH, The Croft, Henley-in-Arden.

INSPECTORS OF SHEARING.

WILLIAM JOBSON, Ashfield, Heaton, Newcastle-on-Tyne.

J. B. WORKMAN, Southend, Upton-on-Severn, Worcestershire.

JUDGES.

CHEESE.

JUBAL WEBB, High Street, Kensington, W.

BUTTER.

JAMES HUDSON, Ludgate Hill, London, E.C.

POULTRY.

Light.

O. E. CRESSWELL, Morney Cross, Hereford.

Heavy.

DAVID BRAGG, Southwaite Hall, Carlisle.

HIVES, HONEY, &c.

W. BROUGHTON CARR, Higher Bebington, Cheshire.
WALTER MARTIN, Wainfleet, Lincolnshire.
Rev. GEORGE RAYNOR, Hazleigh Rectory, Maldon, Essex.

BUTTER-MAKING COMPETITION.

THOMAS CARRICK, Low Row, near Carlisle.

HORSE-SHOEING COMPETITION.

J. M. PARKER, 40, Cannon Street, Birmingham.

CLEMENT STEPHENSON, Sandyford Villa, Newcastle-on-Tyne.

FARMS.

Class 1.

RICHARD BRITTEN, Abington Grange, Northampton.

FREDK. I. COOKE, Flitcham Abbey, Norfolk.

JOSEPH MARTIN, Highfield House, Littleport, Ely, Cambs.

Classes 2 and 3.

HENRY CAMPION, Bletsoe Castle, Bedford.

JOHN J. HARLE, Whitfield, Falfield, R.S.O., Gloucestershire.

THOMAS STIRTON, Estate Office, Stratton, Micheldever, Hants.

AWARD OF PRIZES AT NOTTINGHAM.

NOTE.—The Judges were instructed, in addition to awarding the Prizes, to designate as the *Reserve Number* one animal in each Class, next in order of merit, if it possessed sufficient for a Prize; in case an animal to which a Prize was awarded should subsequently become disqualified.

Prizes given by the Nottingham Local Committee are marked thus (*):

HORSES.

Class 1.—*Shire Stallions foaled previous to the Year* 1885.*
[13 entries.]

No. in Catalogue.

10 A. B. FREEMAN-MITFORD, C.B., Batsford Park, Moreton-in-Marsh, Gloucestershire: FIRST PRIZE, 30*l.*, for "Laughing Stock" (4516), bay; was foaled in 1884; bred by Mr. W. Smith, Flawborough, Orston, Nottinghamshire; *s.* "Merry Lad" (2626); *d.* by "Hydraulic" (1130); *g. d.* by "Thumper" (2132).

13 ALBEMARLE CATOR, Woodbastwick Hall, Norwich: SECOND PRIZE, 15*l.*, for "Julian" (3766), black; was foaled in 1883; bred by Mr. T. Brown, Marham Hall, Downham Market, Norfolk; *s.* "Lord Byron" (351); *d.* "Jewel," by "Brown Champion" (292); *g. d.* by "Wonder" (2357).

11 A. B. FREEMAN-MITFORD, C.B., Batsford Park: THIRD PRIZE, 5*l.*, for "Hitchin Conqueror" (4458), bay; was foaled in 1883, bred by Mr. G. S. Shepperson, Lockington, Derby; *s.* "William the Conqueror" (2343); *d.* "Flower," by "Honest Prince" (1058); *g. d.* by "Warrior" (Nix's).

12 THE COUNTESS OF CAMPERDOWN, Weston House, Shipston-on-Stour, Warwickshire: the *Reserve Number* and *Highly Commended*, for "Moderator" (2844), bay; was foaled in 1881; bred by Mr. T. H. Miller, Singleton Park, Poulton-le-Fylde; *s.* "Honest Tom" (1105); *d.* "Trimmer," by "Emperor" (692); *g. d.* by "England's Glory" (733).

Class 2.—*Shire Stallions foaled in the Year* 1885. [13 entries.]

14 LORD HINDLIP, Doveridge Hall, Derby: FIRST PRIZE, 25*l.*, and the CHAMPION PRIZE of 25 guineas,[1] for "All Here" (4829), bay; bred by the late Lord Hindlip, Hindlip Court Farm, Worcester; *s.* "Harold" (3703); *d.* "Bonny," by No. 1 (3898).

23 THOMAS HORROCKS MILLER, Singleton Park, Poulton-le-Fylde, Lancashire: SECOND PRIZE, 15*l.*, for "Mohammed" (6173), bay; bred by Mr. T. W. Parnell, Thorney, Peterborough; *s.* "Thorney Tom" (3370); *d.* "Flower," by "Thumper" (2126).

[1] Given by the Shire Horse Society for the best Shire Stallion.

22 WALTER GILBEY, Elsenham Hall, Essex: THIRD PRIZE, 5*l.*, for "King Henry" (5336) (late "Silverwood"), black; bred by Mr. J. Skelton, Carlton Grange, Newmarket, Cambridgeshire; *s.* "Staunton Hero" (2918); *d.* "Withersfield Brown," by "Heart of Oak" (1009).

18 HENRY BROWNE, Bury, Huntingdonshire: the *Reserve Number* for "Sailor Prince" (5320), bay; bred by Mr. S. Hurry, Willow Hall, Peterborough; *s.* "Thorney Fen Thumper" (4742); *d.* by "Samson" (1976); *g. d.* by "Major" (1462).

Class 3.—*Shire Stallions foaled in the Year* 1886. [36 entries.]

35 THE EARL OF ELLESMERE, Worsley Hall, Manchester: FIRST PRIZE, 25*l.*, and the *Reserve Number* for CHAMPION PRIZE, for "R.R." (6300), chestnut; bred by Mr. J. Woodhouse, Stalmine, Poulton-le-Fylde, Lancashire; *s.* "M.M." (3205); *d.* "Bess," by "Sir Colin" (2022); *g. d.* by "Ploughboy" (1745).

53 THOMAS HORROCKS MILLER, Singleton Park, Poulton-le-Fylde: SECOND PRIZE, 15*l.*, for "Moloch" (6174), bay; bred by Messrs. Swarbrick Brothers, Hey Houses, Lytham, Lancashire; *s.* "Fen Champion" (3085); *d.* by "What's Wanted" (2332).

42 CLEMENT KEEVIL, Blagdon, Malden, Surrey: THIRD PRIZE, 5*l.*, for "Peasant Boy" (6255), grey; bred by Mr. G. F. Ogle, Bankside House, Thorne, Doncaster, Yorkshire; *s.* "Lincolnshire Lad II." (1365); *d.* by "Sir Roger" (2026); *g. d.* by "Farmer's Profit" (876).

56 WILLIAM CECIL SALT, Willington, Burton-on-Trent: the *Reserve Number* and *Highly Commended*, for "Albert Edward" (5467), brown; bred by Mrs. Hulland, Eggington, Burton-on-Trent; *s.* "Royal Albert;" *d.* "Mettle," by Noble (1641).

Nos. 34, 45, 57, and 59 were *Highly Commended.*

Class 4.—*Shire Stallions foaled in the Year* 1887. [23 entries.]

65 JOHN ADCOCK BARRS, Nailstone Stud Farm, Hinckley, Leicestershire: FIRST PRIZE, 15*l.*, for his bay; bred by Mr. Champion, Heather, Ashby-de-la-Zouch, Leicestershire; *s.* "Big Ben" (3459); *d.* "Snip," by "Appleby Champion."

63 FREDERICK WARD, Quarrington, Sleaford, Lincolnshire: SECOND PRIZE, 10*l.*, for "Reciprocity," brown; bred by Mr. J. Ward, Snake Hall, Moulton Eaugate, Spalding, Lincolnshire; *s.* "King John" (4502); *d.* "Blossom," by "England's Glory" (750); *g. d.* "Brown," by "Brown Champion" (292).

69 THE EARL OF ELLESMERE, Worsley Hall, Manchester: THIRD PRIZE, 5*l.*, for "Black Watch," black; bred by himself; *s.* "Sir Colin" (2022); *d.* "Western Blossom," by "William the Conqueror" (2343).

75 WALTER GILBEY, Elsenham Hall, Essex: the *Reserve Number* and *Highly Commended*, for "Warrior Duke," bay; bred by Mr. Hollingworth, Weston-on-Trent, Derbyshire; *s.* "Duke of Hitchin" (3063); *d.* "Mettle," by "Warrior" (2245).

Nos. 71, 73, and 82 were *Highly Commended.*

Nos. 64, 68, 74, 77, and 85 were *Commended.*

Class 5.—*Clydesdale Stallions foaled in the Year* 1885. [8 entries.]

90 The Duke of Portland, Welbeck, Worksop, Nottinghamshire: First Prize, 25*l.*, for "Macaulay" (5187), brown; bred by Mr. Mark J. Stewart, M.P., Southwick, Dumfries; *s.* "Macgregor;" *d.* "Lady Baily," by "Pointsman."

86 The Marquis of Londonderry, Seaham Hall, Seaham Harbour, Co. Durham: Second Prize, 15*l.*, for "The Regent" (5408), bay; bred by himself; *s.* "The Viscount;" *d.* "Lucy," by "The Tifter."

88 John Kerr, Red Hall, Wigton, Cumberland: Third Prize, 5*l.*, for "Royal Bank" (5309), brown; bred by Mr. W. Reid, Portnellan, Alexandria, Dumbartonshire; *s.* "Belted Knight" (1395): *d.* "Nina of Portnellan," by "Farmer" (286); *g. d.* "Nelly" (1666), by "Prince of Wales" (673).

91 Richard B. Brockbank, Crosby, Maryport, Cumberland: the *Reserve Number* and *Highly Commended*, for "Barcheskie" (4827), bay; bred by Mr. A. Mitchell, Barcheskie, Kirkcudbrightshire; *s.* "Crown Jewel" (2708); *d.* "Brenda of Barcheskie" (4901): by "Young Darnley" (1874); *g. d.* "Bess" (566), by "Robbie Burns" (700).

Class 6.—*Clydesdale Stallions foaled in the Year* 1886. [13 entries.]

103 Andrew Montgomery, Nether Hall, Castle Douglas, Kirkcudbrightshire: First Prize, 25*l.*, for "Sir Percival" (6300), brown; bred by Mr. Mark J. Stewart, M.P., Ardwell, Stranraer, N.B.; *s.* "Darnley" (222); *d.* "Susanna of Ardwell," by "Prince Albert;" *g. d.* "Sally" (282), by "Samson" (741).

101 Andrew Baird Matthews, British Linen Bank, Newton Stewart, Wigtown: Second Prize, 15*l.*, for "Top Knot" (6360), bay; bred by Mr. G. McCormick, Barquhill, Wigtown, N.B.; *s.* "Top Gallant" (1850); *d.* "Blue Bell" (5568) by "Premier" (595).

105 The Earl of Cawdor, Stackpole Court, Pembroke: Third Prize 5*l.*, for "Macbeth" (6188) (late "Oceana"), bred by Mr. G. Anderson, West Fingask, Old Meldrum; *s.* "McCamon" (3818); *d.* "Octoroon" (3703), by "Kenmuir Prince" (1459); *g. d.* "Better" (647), by "Kenmuir" (426).

97 The Marquis of Londonderry, Seaham Hall, Seaham Harbour, Co. Durham: the *Reserve Number* and *Highly Commended* for "Jupiter" (5905), black; bred by himself; *s.* "Castlereagh;" *d.* "Juno," by "St. Lawrence;" *g. d.* "Jess," by "Emperor."

Class 7.—*Clydesdale Stallions foaled in the Year* 1887. [10 entries.]

110 Lords Arthur and Lionel Cecil, Orchardmains, Innerleithen, Peeblesshire: First Prize 15*l.*, for "M'Claskie," bay; bred by themselves; *s.* "M'Gregor" (1487); *d.* "Kelpie" (2034), by "Young Lord Lyon" (994); *g. d.* "Darling" (340), by "Lorne" (499).

115 Richard B. Brockbank, Crosby, Maryport, Cumberland: Second Prize, 10*l.*, for "Prince of Crosby," brown; bred by himself; *s.* "Maccombie" (4555); *d.* "Princess of Kirkbean" (1966), by "Prince of Kirkbean" (1269); *g. d.* "Smiler," by "England's Glory."

116 John Kerr, Red Hall, Wigton, Cumberland: Third Prize, 5*l.*, for "Master Jack," brown; bred by Mr. S. P. Foster, Killhow, Mealsgate, Carlisle; *s.* "St. Gatien" (3988); *d.* "Trimmer" (6181), by "Young Robbie Burns" (1369).

107 George Rodger, Newton Bank, Preston Brook, Warrington: the *Reserve Number* and *Highly Commended,* for "Erl King," bay; bred by Mr. Ross, Cromarty House, N.B.; *s.* "Royal Knight" (3977); *d.* "Queen" (4425), by "Druid" (1120); *g. d.* "Queen Mary," by "Topsman" (886).

Class 8.—*Suffolk Stallions foaled in the Year* 1885. [7 entries.]

119 Alfred James Smith, Rendlesham, Woodbridge, Suffolk: First Prize, 20*l.*, for "Stockwell" (1692), chestnut; bred by Messrs. Pratt and Sons, Melton, Woodbridge; *s.* "Buck" (1579); *d.* "Scott" (1954), by "Prince Imperial" (1239); *g. d.* "Brag" (644), by "Talbot" (378).

117 Horace Wolton, Newbourn Hall, Woodbridge: Second Prize, 10*l*, for "Emperor" (1611), chestnut; bred by himself; *s.* "Wolton Diadem" (1553); *d.* "Empress of Paris" (1033), by "Royal Duke II." (1366); *g. d.* "Newbourn Pride" (1046), by "Monarch" (1348).

118 Alfred James Smith, Rendlesham: the *Reserve Number* and *Highly Commended,* for "Samson" (1778), chestnut; bred by Mr. A. Preston, Worlingworth, Wickham Market, Suffolk; *s.* "Cupbearer III." (566); *d.* "Matchet" (728), by Stanford's "Prince" (1141); *g. d.* "Depper," by Johnson's "Goliath" (745).

Class 9.—*Suffolk Stallions foaled in the Year* 1886. [12 entries.]

124 Horace Wolton, Newbourn Hall, Woodbridge: First Prize, 20*l.*, for "Queen's Diadem" (1721), chestnut; bred by himself; *s.* "Wolton's Diadem" (1533); *d.* "Queen of Newbourn" (1049), by "Captain Snap" (142); *g. d.* "Duchess of Newbourn" (1032), by "Warrior" (1353).

125 Alfred James Smith, Rendlesham: Second Prize, 10*l.*, for "Hotspur" (1774), chestnut; bred by Mr. W. Everitt, Levington, Ipswich; *s.* "Prince Charlie" (1464); *d.* "Smart" (1409), by "Major Snap" (155); *g. d.* "Doughty."

129 William Wilson, Baylham Hall, Ipswich, Suffolk: the *Reserve Number* and *Highly Commended,* for "Great Hocks" (1772), chestnut; bred by Mr. Burch, Winston, Debenham, Suffolk; *s.* "Vanguard" (1327); *d.* "Crown Jewel" (132), by "Conqueror" (78); *g. d.* "Diamond," by "Royal George" (181).

Nos. 127 and 131 were *Commended.*

Class 10.—*Thoroughbred Stallions suitable for getting Hunters.* [10 entries.]

136 Colonel Frederic Barlow, Hasketon, Woodbridge: the Prize of 50*l.*, for "Baldur," chestnut; foaled in 1883; bred by the Duke of Westminster, Eaton Hall, Chester; *s.* "Doncaster;" *d.* "Freia," by "Hermit."

139 W. Burdett-Coutts, M.P., Holly Lodge, Highgate, London: the *Reserve Number* and *Highly Commended,* for "Truefit," chestnut; foaled

in 1880; bred by the late Mr. C. Snewing, Watford, Hertfordshire; *s.* "Outfit;" *d.* "Eleanora," by "Wild Dayrell;" *g. d.* "Lady Peel," by "Orlando."

Nos. 140 and 144 were *Highly Commended.*

Class 11.—*Coaching or Cleveland Stallions.* [10 entries.]

152 W. Burdett-Coutts, M.P., Holly Lodge: First Prize, 20*l.*, for "Sultan" (667), bay; foaled in 1884; bred by Mr. G. Leefe, Fryton, Slingsby, Yorkshire; *s.* "Emperor" (387); *d.* "Beauty."

146 Christopher W. Wilson, Rigmaden Park, Kirkby Lonsdale, Westmoreland: Second Prize, 10*l.*, for "Lord Rowland," bay; foaled in 1885; bred by Mr. T. Harrison, Rowland Hill, Pocklington, Yorkshire; *s.* "Golden Emperor;" *d.* by "Inkerman;" *g. d.* by "Paulinus."

150 Francis Henry Stericker, Danby House, Pickering, Yorkshire; Third Prize, 5*l.*, for "The Baron" (1207), dark bay; foaled in 1886; bred by Mr. M. Porritt, Danby, Castleton, Yorkshire; *s.* "Favourite" (581); *d.* by "Bass Rock;" *g. d.* by "Barnaby" (670).

149 Major Arthur Fitzpatrick Godman, Smeaton Manor, Northallerton, Yorkshire: the *Reserve Number*, for "Guardsman," bay; foaled in 1885; bred by Mr. Isaac Scarth, Mount Pleasant, West Rounton, Northallerton; *s.* "Prince of Cleveland" (647); *d.* "Darling," by "Salesman" (272); *g. d.* by "Successor" (301).

Class 12.—*Hackney Stallions above* 15 *hands.* [10 entries.]

158 Nathaniel Shaw Brough, of Londesbro' Wold, Market Weighton, Yorkshire: First Prize, 20*l.*, for "Matchless" (1517), chestnut; foaled in 1884; bred by himself; *s.* "Danegelt;" *d.* "Lady Lyons," by "Lord Lyons;" *g. d.* "Flora," by "Sir Charles."

156 Henry Moore, Burn Butts, Cranswick, Hull: Second Prize, 10*l.*, for "Confidence" (163), chestnut; foaled in 1880; bred by himself; *s.* "Denmark" (177); *d.* "Poll III." (274), by "Fireaway" (242); *g. d.* "Poll II." by "Black Rattler" (82).

160 Walter Gilbey, Elsenham Hall, Essex: Third Prize, 5*l.*, for "County Member" (948), brown; foaled in 1881; bred by Mr. T. Reed, Wood House, Beeford, Hull; *s.* "Lord Derby" (417); *d.* by "Kendale Performer" (391); *g. d.* by "Grey Wildfire" (P. Ramsdale).

163 Richard Tennant, Kirkburn Grange, Driffield, Yorkshire: the *Reserve Number* and *Highly Commended*, for "Connaught" (1453), chestnut; foaled in 1884; bred by himself; *s.* "Denmark" (Bourdass); *d.* "Fanny" (114), by "Fireaway" (249); *g. d.* "Polly" (1317), by "Bay Phenomenon" (898).

No. 161 was *Commended.*

Class 13.—*Hackney Stallions above* 14 *hands and not exceeding* 15 *hands.* [4 entries.]

169 John Robinson, Cleveland House, Coltman Street, Hull: First Prize, 20*l.*, for "Young Lord Derby," chestnut; foaled in 1884; bred by Mr. T. Stephenson, Ulrome, Lowthorpe, Hull; *s.* "Lord Derby II."; *d* "Maid-of-all-Work."

167 ALFRED LEWIS, Heacham, Lynn, Norfolk: SECOND PRIZE, 10*l*., for "Confidential" (1379), bay; foaled in 1883; bred by Mr. J. Morton, Stow Bardolph Fen, Downham, Norfolk; *s.* "Confidence" (158).

166 ANTHONY HAMOND, Westacre, Swaffham, Norfolk: THIRD PRIZE, 5*l*., for "Van Tromp," roan; foaled in 1886; bred by Mr. H. Tallent, Abbey Farm, Westacre; *s.* "Viking" (1216); *d.* "Tulip," by "Little Wonder" (409).

Class 14.—*Pony Stallions above* 12 *hands and not exceeding* 14 *hands.* [9 entries.]

171 CHRISTOPHER W. WILSON, Rigmaden Park, Kirkby Lonsdale, Westmoreland: FIRST PRIZE, 15*l*., for "Pomfret Wonder" (1371), black; foaled in 1879; bred by Mr. J. Wright, Parkhouse, Doncaster; *s.* "Little Wonder" (1237), alias "Young Confidence"; *d.* "Wrynose," by "Sir George" (778).

170 CHRISTOPHER W. WILSON: SECOND PRIZE, 10*l*., for "Little Wonder II." (1610), brown; foaled in 1883; bred by himself; *s.* "Little Wonder" (1237), alias "Young Confidence;" *d.* "Snorer," by "Sir George" (778); *g. d.* "Pet."

175 GEORGE MANN NICHOLSON, Brisley Hall, East Dereham, Norfolk: THIRD PRIZE, 5*l*., for "Pick Up" (1087), bay; foaled in 1881; bred by Mr. Huggings, Fakenham, Norfolk; *s.* "Model" (1054).

174 SIR ROBERT WILMOT, Bart., Binfield Grove, Bracknell, Berkshire: the *Reserve Number* and *Highly Commended,* for "Look Here," bay; foaled in 1885; bred by Mr. Graves, Lenwade, Norwich; *s.* "Monarch" (463), *d.* by "Docking Robin Hood" (1764).

No. 178 was *Commended.*

Class 15.—*Shire Mares and Foals.* [19 entries.]

191 A. B. FREEMAN-MITFORD, C.B., Batsford Park, Moreton-in-Marsh, Gloucestershire: FIRST PRIZE, 20*l*., and the CHAMPION PRIZE of 15 guineas,[1] for "Chance," black; was foaled in 1880 [foal by "Hitchin Conqueror (4458)]; bred by Mr. Lawrenson, Ash Farm, Preesall, Lancashire; *s.* "Lincoln" (1350); *d.* "Brock," by "Ploughboy" (1745); *g. d.* "Brock," by "Prince of Wales" (1809).

184 THE EARL OF ELLESMERE, of Worsley Hall, Manchester: SECOND PRIZE, 10*l*., for "Lady Lincoln," brown; was foaled in 1879 [foal by "Jupiter" (2602)]; bred by Mr. J. H. Smith, Alvaston, Derby; *s.* "Lincolnshire Lad II." (1365); *d.* by "Devonshire" (594).

187 JAMES PERCIVAL CROSS, of Catthorpe Towers, Rugby, Warwickshire: THIRD PRIZE, 5*l*., for "Kate," brown; was foaled in 1878 [foal by "Harold" (3703)]; bred by Mr. W. Tattam, Springrove Farm, Winslow, Buckinghamshire; *s.* "Active" (51).

186 THE EARL OF ELLESMERE: the *Reserve Number* and *Highly Commended,* for "Blackpool," black; was foaled in 1884 [foal by "Shrewsbury" (4681)]; bred by Mr. Peter Blundell, Ream Hills, Kirkham, Lancashire; *s.* "Bar None" (2388); *d.* "Black Depper," by "Sir Colin" (2022); *g. d.* by "Sir Roger" (2026).

Nos. 180 and 182 were *Highly Commended.*

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[1] Given by the Shire Horse Society for the best Shire Mare or Filly.

Class 16.—*Colt Foals, the produce of Mares, exhibited in Class* 15.*
[6 entries.]

199 JOHN HARRISON, Wilstrop Hall, Green Hammerton, Yorkshire: FIRST PRIZE, 10*l.*, for "Lord Nottingham," bay; was foaled in 1888; bred by himself; *s.* "Defiance;" *d.* "Nottingham Lady," by "Kenilworth."

Class 17.—*Filly Foals, the produce of Mares exhibited in Class* 15.*
[5 entries.]

205 ROBERT MILLINGTON KNOWLES, Colston Bassett Hall, Bingham, Nottinghamshire: FIRST PRIZE, 10*l.*, for his bay; was foaled in 1888; bred by himself; *s.* "Bar None" (2388), *d.* "Pride of Colston," by "Ace of Trumps" (17).

208 LORD BELPER, Kingston Hall, Derby: SECOND PRIZE, 5*l.*, for his brown; was foaled in 1888; bred by himself; *s.* "Charter" (2740); *d.* "Violet," by "Farmer" (2578).

204 H.R.H. THE PRINCE OF WALES, K.G., Sandringham, Norfolk: the *Reserve Number* for his black; was foaled in 1888; bred by His Royal Highness; *s.* "Gracchus" (3104); *d.* "Jewel," by "Sir Colin."

Class 18.—*Clydesdale Mares and Foals.* [6 entries.]

214 ROBERT WILSON, Mansurae, Kilbarchan, Renfrewshire: FIRST PRIZE, 20*l.*, for "Jeanie Wilson," dark brown; was foaled in 1881 [foal by St. Laurence]; bred by Mr. J. Fleming, Crookstone, Paisley, N.B.; *s.* "Top Gallant;" *d.* by "Prince of Renfrew."

209 THE MARQUIS OF LONDONDERRY, Seaham Hall, Seaham Harbour, Co. Durham; SECOND PRIZE, 10*l.*, for "Star" (3739), bay; was foaled in 1881 [foal by Castlereagh]; bred by himself; *s.* What Care I; *d.* "Daisy," by "Time o' Day."

210 THE DUKE OF PORTLAND, Welbeck Abbey, Worksop, Nottinghamshire: THIRD PRIZE 5*l.*, for "Loyalty," bay; was foaled in 1883 [foal by Auld Reekie (1920)], bred by Mr. J. Park, Bechmont, Cambuslang, N.B.; *s.* "Lord Erskine" (1744); *d.* "The Twin" (625), by "Prince of Wales" (673) *g. d.* "Lilly," by "Ailsa."

Class 19.—*Suffolk Mares and Foals.* [6 entries.]

216 HORACE WOLTON, Newbourn Hall, Woodbridge, Suffolk: FIRST PRIZE, 20*l.*, for "Queen of Newbourn" (1049), chestnut; was foaled in 1875 [foal by Chieftain (1354)]; bred by himself; *s.* "Captain Snap" (142); *d.* "Duchess of Newbourn" (1032), by "Warrior" (1353); *g. d.* "Victoria" (1011), by "Barthropp's Hero" (88).

215 ROBERT HENRY WRINCH, Harkstead, Ipswich, Suffolk: SECOND PRIZE, 10*l.*, for "Juno" (1500), chestnut; was foaled in 1881 [foal by "Chieftain" (1354)]; bred by Messrs. Rope, Leiston, Saxmundham; *s.* "Cupbearer III." (566); *d.* "Moggy;" *g. d.* "Scott."

220 THE DUKE OF HAMILTON AND BRANDON, K.T., Easton Park, Wickham Market: the *Reserve Number* and *Highly Commended*, for "Gandy Poll" (1606), chestnut; was foaled in 1881 [foal by "The Wanderer" (1463)]; bred by himself; *s.* "Statesman" (657); *d.* "Smart" (430), by "Emperor" (279); *g. d.* by "Chester Emperor" (32).

Class 20.—*Hunter Mares and Foals.* [10 entries.]

223 James Martin, Wainfleet, Lincolnshire: First Prize, 20*l.*, for "Yorkshire Lassie," chestnut; was foaled in 1879 [foal by "Fabius"]; bred by Lord Londesborough; *s.* "The Mallard;" *d.* by "Cariboo."

222 Captain Fife, Sandley House, Gillingham, Dorsetshire: Second Prize, 10*l.*, for "Mermaid," bay, aged [foal by "Scot Guard"]; breeder unknown; *s.* "Baron Cavendish;" *d.* by "The Dean."

229 Robert James Mann, Home Farm, Acton Burnell, Shropshire: Third Prize, 5*l.*, for "Maid of Mowbray," black; was foaled in 1879 [foal by "Vienna"]; bred by Mr. Noton, Topcliffe, Thirsk, Yorkshire; *s.* "Baron Cavendish;" *d.* by "Ainderby;" *g. d.* by "Abernethy."

226 Charles Miles, Tatenhill, Burton-on-Trent, Staffordshire: the *Reserve Number* and *Highly Commended*, for "Isoretta," bay; was foaled in 1882 [foal by Lahnstein]; bred by Lady Emily Peel, Bonehill Paddocks, Tamworth; *s.* "Isonomy;" *d.* "Infanta," by "Pero Gomez," *g. d.* by "West Australian."

Nos. 224 and 225 were *Commended.*

Class 21.—*Hunter Mares in Foal, and not with Foals at foot.* [2 entries.]

232 John Goodwin, Priory Court, Cheltenham, Gloucestershire: First Prize, 15*l.*, for "Marion," chestnut; was foaled in 1878; breeder unknown; *s.* "Grand Master;" *d.* by "General Williams."

231 Albert Armitage, Cotgrave Place, Radcliffe-on-Trent, Nottinghamshire: Second Prize, 10*l.*, for "Empress," brown; was foaled in 1877; bred by Mr. Stephens, Newmarket; *s.* "Fortunis."

Class 22.—*Coaching or Cleveland Mares and Foals.* [6 entries].

233 George Scoby, Beadlam Grange, Nawton, Yorkshire: First Prize, 15*l.*, for "Hannah," bay; was foaled in 1885 [foal by "Charioteer" (702)]; bred by himself; *s.* "Salesman;" *d.* "Sinnington Lass," by "Candidate" (64); *g. d.* "Smiler," by "Pride of England" (228).

234 W. Burdett-Coutts, M.P., Holly Lodge, Highgate, London: Second Prize, 10*l.*, for "Lily," bay; was foaled in 1883 [foal by "Sultan" (667)]; bred by Mr. J. White, the Grange, Appleton Roebuck, Bolton Percy, Yorkshire; *s.* "Candidate" (64); *d.* by "Progress;" *g. d.* by "Hopeful" (223).

238 James Firth Crowther, Knowl Grove, Mirfield, Yorkshire: the *Reserve Number*, for "Lady Hilda" (190), bay; was foaled in 1883 [foal by "Santon," (785)], bred by Mr. W. Kitching, Houghton-le-Side, Darlington; *s.* "Sportsman" (291); *d.* "Darling" (152); by "Forester" (112); *g. d.* by "Prince Albert" (231).

Class 23.—*Hackney Mares and Foals above* 14 *hands* 2 *inches.* [14 entries.]

241 Thomas Nicholson, the Grange, Watton, Hull: First Prize, 15*l.*, for "Belle II.," bay; was foaled in 1882 [foal by "Wildfire" (1224)]; bred by himself; *s.* "Denmark" (177); *d.* "Belle" (20), by "Fireaway" (249); *g. d.* "Violet," by "Screveton."

240 HENRY MOORE, Burn Butts, Cranswick, Hull: SECOND PRIZE, 10*l.*, for "Primrose" (827), chestnut; was foaled in 1884 [foal by "Lord Derby II." (417)]; bred by himself; *s.* "Denmark" (177); *d.* "Empress" (95), by "Fireaway" (249); *g. d.* "Poll III." (274), by "Fireaway" (242*l.*)

246 JOHN G. MACKIE, Auchencairn, Castle Douglas, Kirkcudbrightshire: THIRD PRIZE, 5*l.*, for "Silver Belle," chestnut roan; was foaled in 1883 [foal by "Dorrington II."] bred by Mr. T. R. Burnham, Frodingham Hall, Yorkshire; *s.* "Lord Derby II." (417); *d.* "Lady Landseer," (462), by "Sir Edwin Landseer" (774).

239 WILLIAM HEARNSHAW, Fox Hill, Burton Joyce, Nottinghamshire: the *Reserve Number* and *Highly Commended*, for "Peggy," chestnut; [foal by "Little Gun"]; age and breeder unknown.

Nos. 242, 245, and 252 were *Highly Commended.*

Class 24.—*Hackney Mares and Foals above* 13 *hands* 2 *inches, and not exceeding* 14 *hands* 2 *inches.* [4 *entries.*]

254 ERNEST LAVERTON, Shottle Hall, Shottle, Derby: FIRST PRIZE, 15*l.*, for "Stella," chestnut; was foaled in 1880 [foal by "Young Ratcatcher"]; breeder unknown.

255 WILLIAM HARDWICK, Burstwick, Hull: SECOND PRIZE, 10*l.*, for "Fanny," brown; was foaled in 1884 [foal by "Topper" (1350)]; bred by Mr. R. Bell, Atwick, Hull; *s.* "Skipsea Performer;" *d.* by "Phenomenon;" *g. d.* by "Walkington."

Class 25.—*Pony Mares and Foals above* 12 *and not exceeding* 13 *hands* 2 *inches.* [3 entries.]

259 ROBERT HOUSTON WALKER, Hartwood, West Calder, Edinburgh: FIRST PRIZE, 15*l.*, for "Polly," bay; was foaled in 1877 [foal by "Alpha"]; bred by Mr. W. Peale, late of Hull; *s.* "Prime Minister;" *d.* by "Tom Thumb."

258 JAMES FORSHAW, Carlton-on-Trent, Newark, Nottinghamshire: SECOND PRIZE, 10*l.*, for "Crafty," bay; was foaled in 1884 [foal by "Bluebeard"]; bred by himself; *s.* "Nobby."

Class 26.—*Shire Fillies foaled in the Year* 1885. [14 entries.]

273 LORD WANTAGE, K.C.B., V.C., Lockinge Park, Wantage, Berkshire: FIRST PRIZE, 15*l.*, and the *Reserve Number* for CHAMPION PRIZE, for "The Forest Queen," brown; bred by Mr. W. W. MacGibbon, Rangemore, Burton-on-Trent; *s.* "Royal Albert" (1885); *d.* "Madam" by "Hercules" (1022); *g. d.* by "Sweet William" (2093).

263 THE EARL OF ELLESMERE, Worsley Hall, Manchester: SECOND PRIZE 10*l.*, for "Princess Louisa," brown; bred by Mr. J. Sargeant, Cheddleton, Derbyshire; *s.* "Royal Albert" (1885); *d.* by "Champion Hero" (3526).

269 ALFRED HENRY CLARK, Moulton Eaugate, Spalding, Lincolnshire: THIRD PRIZE, 5*l.*, for "Wedger," grey; bred by Messrs F. and F. Howard, Parson's Drove, Wisbech, Cambridgeshire; *s.* "Thumper" (2136); *d.* "Blossom," by "Admiral" (69).

264 THE HON. E. K. W. COKE, Longford Hall, Longford, Derbyshire: the *Reserve Number* and *Highly Commended*, for "Courtship," chestnut;

bred by Mr. T. Wayte, Willington Hill, Derbyshire; *s.* "Admiral Thumper" (2520); *d.* by "Champion" (419).

Nos. 260, 261, 262, 265, 268, and 271 were *Highly Commended.*

Class 27.—*Shire Fillies foaled in the year* 1886. [29 entries.]

279 The Earl of Ellesmere, Worsley Hall: First Prize, 15*l.*, for "Nectarine," black; bred by himself; *s.* "Western King" (4172); *d.* "Nectar," by "Nonpareil" (2470).

293 Walter Gilbey, Elsenham Hall, Essex: Second Prize, 10*l.*, for "Playmate," brown; bred by Mr. W. R. G. Farmer, White Hall, Littleport, Ely, Cambridgeshire; *s.* "Premier" (2646); *d.* "Darling," by "Waxwork" (2309).

286 The Hon. E. K. W. Coke, Longford Hall, Longford, Derbyshire: Third Prize, 5*l.*, for "Cerise," red roan; bred by Mr. W. Bird, Foxley, Daventry; *s.* "Royalist" (2488); *d.* by "Drayman" (3058).

291 Vincent Eastgate, Strong's Bank Farm, Holbeach, Lincolnshire: the *Reserve Number* and *Highly Commended*, for "Pride of the Fleet," brown; bred by himself; *s.* "True Briton" (2684); *d.* "Brisk," by "Matchless" (1542); *g. d.* "Flower," by "England's Glory" (723).

Nos. 283 and 298 were *Highly Commended.*

Nos. 276, 277, 285, 288, 294, 295, and 297 were *Commended.*

Class 28.—*Shire Fillies foaled in the Year* 1887. [29 entries.]

317 The Hon. E. K. W. Coke, Longford Hall: First Prize, 15*l.*, for "Credit," brown; bred by Messrs. Averill and Wood, Lockwood Hall, Cheadle, Staffordshire: *s.* "Charter" (2740); *d.* by "Sweet William" (2093).

330 Philip Albert Muntz, M.P., Dunsmore, Rugby, Warwickshire: Second Prize, 10*l.*, for "Form of Dunsmore," bay; bred by himself; *s.* "Canute" (2736); *d.* "Lively," by "Lofty" (1420).

329 Philip Albert Muntz, M.P.: Third Prize, 5*l.*, for "Dunsmore Violet," bay; bred by Mr. J. Johnson, Tydd, Wisbech; *s.* "Napoleon" (1604); *d.* by "Captain II." (5641).

308 The Earl of Ellesmere, Worsley Hall: the *Reserve Number* and *Highly Commended*, for "Bloom," grey; bred by Mr. T. Shaw, The Island, Winmarleigh, Garstang; *s.* "Vulcan" (4145); *d.* "Fuchsia," by "Rival" (2885).

No. 312 was *Highly Commended.*

Nos. 306, 307, 311, 314, 316, 319, and 331 were *Highly Commended.*

Class 29.—*Clydesdale Fillies foaled in the Year* 1885. [8 entries.]

338 John Gilmour, Montrave, Leven, Fifeshire: First Prize, 15*l.*, for "Montrave Lady," bay; bred by Mr. D. McKinnon, Poteath, West Kilbride, Ayrshire; *s.* "Topgallant" (1850); *d.* "Fanny of Poteath" (3909).

334 Edward Charlton, Shaw House, Stocksfield-on-Tyne, Northumberland: Second Prize, 10*l.*, for "Black Bess," black; bred by himself; *s.* "Merry Monarch" (538); *d.* "Nanny" (2042), by "Hamilton Jock" (1151); *g. d.* "Black Bess" (183), by "Young Merry Tom" (1001).

335 JOHN CASTLEHOW TOPPIN, Musgrave Hall, Penrith, Cumberland: THIRD PRIZE, 5*l.*, for "Galloway Lass," bay; bred by Mr. J. Kerr, Buittle Place, Dalbeattie, Kirkcudbright; *s.* "Peter the Great" (3884); *d.* "Bet," by "Locklibo" (1468); *g. d.* by "Victor" (892).

333 THE MARQUIS OF LONDONDERRY, Seaham Hall, Seaham Harbour, Co. Durham: the *Reserve Number* and *Highly Commended*, for "Catherine," bay; bred by himself; *s.* "Prince of Wales"; *d.* "Lady Colin," by "Lord Colin Campbell;" *g. d.* "Clydesdale Maggie," by "Old Times."

Class 30.—*Clydesdale Fillies foaled in the Year* 1886. [9 entries.]

346 JOHN GILMOUR, Montrave, Leven, Fifeshire: FIRST PRIZE, 15*l.*, for "Primrose," brown; bred by Mr. D. A. Hood, Balgreddan, Kirkcudbright; *s.* "Darnley" (222); *d.* "Maggie of Balgreddan" (781).

342 ANDREW BAIRD MATTHEWS, the British Linen Bank, Newtonstewart, Wigtownshire: SECOND PRIZE, 10*l.*, for "Top Blossom," brown; bred by Mr. T. Muir, Challock, Newtonstewart; *s.* "Topgallant" (1850); *d.* "Blossom" (1519), by "Warrior" (902); *g. d.* "Maggie," by "Lochend Champion" (1448).

344 ANDREW MONTGOMERY, Nether Hall, Castle Douglas, Kirkcudbrightshire: THIRD PRIZE, 5*l.*, for his brown; bred by Mr. W. Rain, Kempleton, Twynholm, Kirkcudbright; *s.* "Skelmorlie" (4027); *d.* "Lily" (892), by "Prince of Wales" (677); *g. d.* by "Rob Roy" (714).

347 RICHARD B. BROCKBANK, Crosby, Maryport, Cumberland: the *Reserve Number* and *Highly Commended*, for "Crosby Lass," bay; bred by himself; *s.* "Macgregor" (1487); *d.* "Crosby Bet" (1029), by "Clydesdale Tom" (176); *g. d.* "Sall" (1028), by "Lord Clyde" (477).

No. 340 was *Commended.*

Class 31.—*Clydesdale Fillies foaled in the Year* 1887. [10 entries.]

350 ROBERT SINCLAIR SCOTT, of Craigievar, Skelmorlie, Ayrshire: FIRST PRIZE, 15*l.*, for "Scottish Rose," bay; bred by the Trustees of the late Mr. J. M'Clew, Dinvin, Portpatrick, Wigtown; *s.* "Darnley" (222); *d.* "Ethel Newcome" (2599), by "Clansman" (150); *g. d.* "Tibbie."

354 ANDREW MONTGOMERY, Nether Hall, Castle Douglas: SECOND PRIZE, 10*l.*, for his bay; bred by Messrs. Kerr and Craig, Auchengool, Castle Douglas; *s.* "MacGregor" (1487); *d.* "Mag" (2418), by "Samson" (741).

356 THE EARL OF CAWDOR, Stackpole Court, Pembroke: THIRD PRIZE, 5*l.*, for "Snowdrift," bay; bred by himself; *s.* "St. Govens" (3527); *d.* "Miss Baxter" (4478), by "Simon Pure" (769); *g. d.* "Blossom," by "Dumbarton" (253).

358 ROBERT WILSON, Mansurae, Kilbarchan, Renfrewshire: the *Reserve Number* and *Highly Commended*, for "Jeanie Wilson III.," brown; bred by himself; *s.* "Sir Hildebrand;" *d.* "Jeanie Wilson I.," by "Top Gallant."

No. 352 was *Commended.*

Class 32.—*Suffolk Fillies foaled in the Year* 1885. [2 entries.]

359 ALFRED JAMES SMITH, Rendlesham, Woodbridge, Suffolk: FIRST PRIZE, 15*l.*, for "Sally," chestnut; bred by himself; *s.* "Cupbearer III." (566); *d.* "Rendlesham Smart" (840), by "Briton" (1303); *g. d.* "Tuddenham Doughty" (844), by "Sir Colin" (544).

360 SAMUEL WOLTON, Butley Abbey, Wickham Market, Suffolk: SECOND PRIZE, 10*l.*, for "Smart" (1763), chestnut; bred by himself; *s.* "Wolton's Chieftain" (1354); *d.* "Blyth II." (1073), by "Wolton's Monarch" (1348); *g. d.* "Blyth" (1072), by "Crisp's Duke" (419).

Class 33.—*Suffolk Fillies foaled in the Year* 1886. [10 entries.]

365 ALFRED J. SMITH, Rendlesham: FIRST PRIZE, 15*l.* for "Dora," chestnut; bred by himself; *s.* "Monk" (1562); *d.* "Darling" (1617), by "Field Marshal" (1106); *g. d.* "Eyke Depper," by "Crisp's Chillesford Duke."

370 THE DUKE OF HAMILTON AND BRANDON, K.T., Easton Park, Wickham Market, Suffolk: SECOND PRIZE, 10*l.*, for "Vesta" (1997), chestnut; bred by Mr. S. Wolton, Butley Abbey, Wickham Market; *s.* "Chieftain" (1354); *d.* "Foxhall Victory" (1080), by "Magnum Bonum" (1347); *g. d.* "Foxhall Ruby" (1079).

362 JAMES TOLLER, Blaxhall, Wickham Market: the *Reserve Number* and *Highly Commended*, for "Valiant," chestnut; bred by himself; *s.* "Toller's Verger" (1550); *d.* "Venus" (923), by "Hercules" (1167A).

Nos. 361, 363, 364, 366, 368, and 369 were *Commended.*

Class 34.—*Hunter Mares or Geldings up to* 15 *stones, foaled previously to the Year* 1884.* [13 entries.]

382 J. V. KEEVIL, Shaw Farm, Melksham, Wiltshire: FIRST PRIZE, 30*l.*, for "Conundrum," chestnut gelding; was foaled in 1882; breeder unknown; *s.* "New Oswestry."

377 JOHN HENRY STOKES, Great Bowden House, Market Harborough, Leicestershire: SECOND PRIZE, 15*l.*, for "Nigger," black gelding; was foaled in 1882; breeder unknown.

381 TIMOTHY CATTLE, Digby House, Melton Mowbray, Leicestershire: THIRD PRIZE, 5*l.*, for "Criterion," bay gelding; was foaled in 1883; breeder unknown; *s.* "Cambuslang."

371 LORD BURTON, Rangemore Hall, Burton-on-Trent, the *Reserve Number* and *Highly Commended*, for "Tip Top," bay gelding; was foaled in 1880; breeder unknown.

No. 376 was *Highly Commended.*

Class 35.—*Hunter Mare or Gelding up to* 12 *stones, foaled previously to the Year* 1884.* [18 entries.]

384 THOMAS CRUTCHER, Ivy Street, Salisbury, Wiltshire: FIRST PRIZE, 25*l.*, for "Huntsman," bay gelding; was foaled in 1882; breeder unknown; *s.* "Old Tom;" *d.* "Awfully Jolly."

400 THE EARL OF HARRINGTON, Elvaston Castle, Derby: SECOND PRIZE, 15*l.*, for "Hodgson," chestnut gelding; was foaled in 1882; bred by himself; *s.* "New Oswestry."

387 JOHN HENRY STOKES, Market Harboro': THIRD PRIZE, 5*l.*, for "Successor," bay gelding; was foaled in 1882; bred by Mr. Howard, Greystoke, Penrith; *s.* "Robin Adair;" *d.* "Sequence," by "Rataplan;" *g. d.* "Result," by "Mulatto."

399 TIMOTHY CATTLE, Digby House: the *Reserve Number* and *Highly Commended*, for "Commotion," bay gelding; was foaled in 1882; breeder unknown; *s.* "Haymaker;" *d.* by "Old Arthur."

Class 36.—*Hunter Geldings foaled in the year* 1884.* [19 entries.]

408 Lord Middleton, Birdsall House, York: First Prize, 25*l.*, for "Beefeater," bay; bred by himself; *s.* "King Harold;" *d.* "Beeswing," by "Morocco;" *g. d.* "Queen Bee," by "Newminster."

419 Frank B. Wilkinson, Blyth Spital, Worksop, Nottinghamshire: Second Prize, 15*l*, for "Golden Drop," chestnut; breeder unknown; *s.* "Haymaker;" *d.* by "Solon."

414 William Wright, Wollaton, Nottingham: Third Prize, 5*l.*, for "The Captain," black; breeder unknown.

406 T. Tomlinson, Bradley Pastures, Ashbourn, Derbyshire: the *Reserve Number* and *Highly Commended*, for "Meynell," bay; bred by Mr. Brough, Seaham; *s.* "Omega;" *d.* "Levity," by "Laughing Stock."

No. 416 was *Highly Commended.*

Class 37.—*Hunter Mares foaled in the Year* 1884. [8 entries.]

425 John Cooper, East Haddon, Northampton: First Prize, 25*l.*, for "Wandering Maid," bay; bred by Mr. W. Villar, New Court, Charlton Kings, Cheltenham; *s.* "Truant;" *d.* "Lady Price."

426 James S. Darrell, West Ayton, York: Second Prize, 15*l.*, for "Brunette," brown; bred by Messrs. Thomas and Sons, Pinchinthorpe, Guisborough; *s.* "Bourbaki;" *d.* "Flower," by "Favourite."

424 William Wright, Wollaton, Nottingham: Third Prize, 5*l.*, for "Barmaid," bay; bred by the late Mr. J. Harper, Prince of Wales Hotel, Harrogate, Yorkshire; *s.* "Peter Grey;" *d.* by "Van Galen."

427 John Machin, Lynby, Nottinghamshire: the *Reserve Number* and *Highly Commended*, for "Flower Girl," bay; bred by Mr. T. Williamson, Oulsyke, Grosmont, Whitby; *s.* "Charles II."

Class 38.—*Hunter Geldings foaled in the Year* 1885.* [18 entries].

440 The Stand Stud Company, Whitefield, Manchester; First Prize, 20*l.*, for "Pilgrim," brown; bred by Mr. E. Barton, of Warton Grange, Carnforth; *s.* "Carthusian;" *d.* "Matilda," by "Voltigeur."

441 William Holtby, Rotsea, Cranswick, Hull; Second Prize, 10*l.*, for "King Twala," brown; bred by Mr. Stirk, Grazing Nook, Bedale.

442 Westley Richards, Ashwell, Oakham: Third Prize, 5*l.*, for "Titan," bay; bred by the Hon. C. W. W. Fitzwilliam, Alwalton, Peterborough; *s.* "Berserker;" *d.* by "Bonnyfield."

437 Lord Middleton, Birdsall House, York; the *Reserve Number* and *Highly Commended*, for his bay; bred by himself; *s.* "Peppermint;" *d.* "Laburnum," by "Morocco."

No. 429 was *Highly Commended.*

Class 39.—*Hunter Fillies (likely to become weight carriers) foaled in the Year* 1885. [10 entries.]

455 John Henry Stokes, Great Bowden House, Market Harborough: First Prize, 15*l.*, for "Golden Stream," brown; breeder unknown; *s.* "Golden Horn;" *d.* by "Kingfisher."

447 CHARLES CLARKE, Ashby-de-la-Launde, Lincoln; SECOND PRIZE, 10*l.*, for "Beatrice," brown; bred by himself; *s.* "Outfit," *d.* by Dagobert.

451 WILLIAM ARKWRIGHT, Sutton Scarsdale, Chesterfield, Derbyshire: THIRD PRIZE, 5*l.*, for "Scarsdale Hawthorne," brown; bred by himself; *s.* "Highthorne;" *d.* by "XX."

454 ROBERT J. MANN, Home Farm, Acton Burnell, Shropshire: the *Reserve Number*, for "Sweetness," chestnut; bred by Mr. T. Wells, Hutton Conyers, Ripon; *s.* "Duc de Beaufort."

Class 40.—*Hunter Geldings foaled in the Year* 1886.* [23 entries.]

463 CHARLES CLARKE, Ashby-de-la-Launde, Lincolnshire: FIRST PRIZE, 20*l.*, for his black; bred by himself; *s.* "Outfit."

472 JOHN ROBINSON, Leckby Palace, Asseuby, Thirsk, Yorkshire: SECOND PRIZE, 10*l.*, for his brown; bred by Mr. J. T. Robinson, Leckby Palace; *s.* "Sedan;" *d.* "Miss Whip," by "Baron Cavendish."

467 JOHN RICHARDSON HOBSON, Crockey Hill, Yorkshire: THIRD PRIZE, 5*l.*, for "Mikado," brown; bred by himself; *s.* "Martyrdom;" *d.* by "Grand Master;" *g. d.* "Gipsy," by "Old Black Boy."

457 EDWARD BARTON, Warton Grange, Carnforth, Lancashire: the *Reserve Number* and *Highly Commended*, for "Boulanger," brown; bred by Mr. Cornthwaite, Claughton Hall, Burton, Westmoreland; *s.* "Carthusian."

Nos. 458, 464, and 477 were *Highly Commended.*

Nos. 461, 466, 468, 470, and 478 were *Commended.*

Class 41.—*Hunter Fillies (likely to become weight carriers) foaled in the Year* 1886. [11 entries.]

490 THOMAS WATSON, Whitacre Hall, Coleshill, Warwickshire: FIRST PRIZE, 15*l.*, for "Makeshift," chestnut; bred by himself; *s.* "Make Haste;" *d.* by "Omar Pasha."

487 CHARLES MILES, Tatenhill, Burton-on-Trent, Staffordshire: SECOND PRIZE, 10*l.*, for "Princess," brown; bred by himself; *d.* "Lavinia," by "Pero Gomez."

484 LORD MIDDLETON, Birdsall House, York: THIRD PRIZE, 5*l.*, for his bay; bred by himself; *s.* "Peppermint," *d.* "Monica," by "Morocco."

480 FRANK GODSON, Temple Bruer, Grantham, Lincolnshire: the *Reserve Number* and *Highly Commended*, for "Improver," chestnut; bred by Mr. Everett, Brant Broughton, Newark; *s.* "Outfit;" *d.* by "Vendome;" *g. d.* by "Broomielaw."

No. 482 was *Commended.*

Class 42.—*Hunter Fillies or Geldings foaled in the Year* 1887.* [19 entries.]

508 NATHANIEL HENRY HODGSON, Old Thornville, York: FIRST PRIZE, 10*l.*, for "Rumtifoozleum," chestnut gelding; bred by himself; *s.* "Highthorn;" *d.* "Maggie," by "Bass Rock."

493 CHARLES CLARKE, Ashby-de-la-Launde, Lincoln: SECOND PRIZE, 5*l.*, for his chestnut gelding; bred by himself; *s.* "Outfit."

509 THOMAS WATSON, Whitacre Hall, Coleshill, Warwickshire: the *Reserve Number* and *Highly Commended*, for "Matchless," black filly; bred by himself; *s.* "Make Haste;" *d.* by "Kentucky."

Nos. 499, 500, and 502 were *Highly Commended*.

Nos. 506 and 507 were *Commended*.

Class 43.—*Hackney or Roadster Mares or Geldings above* 14 *hands and not exceeding* 15 *hands* 2 *inches, up to not less than* 15 *stones.** [4 entries.]

513 JOHN ROBINSON, Cleveland House, Coltman Street, Hull: FIRST PRIZE, 15*l.*, for "Princess," chestnut mare; foaled in 1880; bred by Mr. A. Fewson, Hedon, Hull; *s.* "Lord Derby II.;" *d.* by "Tom Thumb."

510 JOHN LANE, 5, Lea Road, Gainsborough, Lincolnshire: SECOND PRIZE, 10*l.*, for "Emperor," bay gelding; foaled in 1883; bred by Mr. Curtis, Sutton-on-Hull, Yorks; *s.* "Lord Derby II.;" *d.* by "Sportsman."

512 THE STAND STUD COMPANY, Whitefield, Manchester: THIRD PRIZE, 5*l.*, for "King of Fashion," bay gelding; foaled in 1881; breeder unknown.

Class 44.—*Hackney or Roadster Mares or Geldings, above* 14 *hands and not exceeding* 15 *hands* 2 *inches, up to not less than* 12 *stones.** [8 entries.]

518 JOHN ROBINSON, Cleveland House, Coltman Street, Hull: FIRST PRIZE, 15*l.*, for "Lady Tankerville," bay mare, aged; breeder unknown; *s.* "Confidence."

521 HARRY LIVESEY, 2, Victoria Mansions, Westminster, S.W.: SECOND PRIZE, 10*l.*, for "Brunette," chestnut mare; foaled in 1883; bred by Mr. A. Fewson, Hedon, Hull; *s.* "Lord Derby II." (417); *d.* by "Tom Thumb" (830); *g. d.* "Polly," by "Black Rattler."

516 THE STAND STUD COMPANY, Whitefield, Manchester: THIRD PRIZE, 5*l.*, for "Constance," brown mare; foaled in 1884; bred by Mr. S. Rodwell, Burnham Overy, Lynn; *s.* "Confidence" (158).

519 ARTHUR FEWSON, Hedon, Hull: the *Reserve Number* and *Highly Commended*, for "Lady Golightly," chestnut mare; foaled in 1884; bred by Mr. E. Wright, Balrington, Hull; *s.* "Lord Derby II.;" *d.* by "Sir Harry."

No. 517 was *Highly Commended*.

Class 45.—*Pony Mares or Geldings from* 13 *to* 14 *hands.** [2 entries.]

522 MICHAEL FAULKES, Colston Bassett, Bingham, Nottinghamshire: FIRST PRIZE, 10*l.*, for "Lilly," chestnut mare; foaled in 1884; breeder unknown.

523 HENRY SPENCER, Shrubbery House, Ashby-de-la-Zouch, Leicestershire: SECOND PRIZE 5*l.*, for his chestnut gelding; foaled in 1884; bred by Mr. R. Tebbett, Ibstock, Ashby-de-la-Zouch.

Class 46.—*Pony Mare or Gelding, under* 13 *hands.** [4 entries.]

525 JOHN G. MACKIE, Auchencairn, Castledouglas, Kirkcudbrightshire: FIRST PRIZE, 10*l.*, for "Sir Gibbie," brown gelding; foaled in 1882; bred by Mr. Wakefield, Kendal; *s.* "Sir George" (778).

526 THOMAS DOWBIGGEN, Cemetery Road, Castleford, Yorkshire; SECOND PRIZE, 5*l.*, for "Strawberry Boy," roan gelding; foaled in 1883; breeder unknown.

527 WILLIAM FLETCHER, Bath Street, Ilkeston, Derbyshire: the *Reserve Number* and *Highly Commended*, for "Dandy," bay gelding; foaled in 1883; breeder unknown.

Class 47.—*Harness Mares or Geldings, exceeding* 15 *hands.**
[5 entries.]
No exhibit.

Class 48.—*Harness Mares or Geldings exceeding* 14 *hands and not exceeding* 15 *hands.** [9 entries.]

533 HENRY FRISBY, 14, James Street, Buckingham Gate, London: FIRST PRIZE, 15*l.*, for "Movement," skewbald mare; foaled in 1877; bred by Mr. E. C. Cooke, Litcham, Norfolk; *s.* "Washington;" *d.* "Spot."

536 CHARLES FOWLER, 203, High Street, Lincoln: SECOND PRIZE, 10*l.*, for "Maid Marian," bay mare; foaled in 1884; bred by Mr. A. Fewson, Hedon, Hull; *s.* "Lord Derby II.;" *d.* "Polly" (279), by "Charley" (129); *g. d.* by "Tom Thumb."

537 THE STAND STUD COMPANY, Whitefield Manchester: THIRD PRIZE, 5*l.*, for "Conquest," brown gelding; foaled in 1884; breeder unknown; *s.* "Confidence" (158).

539 GEORGE LATHBURY, Hunter's Lodge, Burton-on-Trent, Staffordshire: the *Reserve Number*, for his bay mare; foaled in 1883; bred by Mr. West, Brigg, Lincolnshire; *s.* "Lottery."

Class 49.—*Pony Mares or Geldings not exceeding* 15 *hands.**
[5 entries.]

543 WILLIAM POPE, Cannon House, Downham Market, Norfolk: FIRST PRIZE, 15*l.*, for "Magpie," black and white mare; foaled in 1878; bred by Mr. Cooke, Litcham, Norfolk; *s.* "Confidence" (Youngman's), *d.* "Spot," by "Premier.

542 THE STAND STUD COMPANY, Whitefield, Manchester: SECOND PRIZE, 10*l.*, for "Shooting Star," bay gelding; foaled in 1881; bred by exhibitors; *s.* "Star of the East" (798); *d.* by "Confidence" (158).

545 HENRY FRISBY, 14, James Street, Buckingham Gate, London: THIRD PRIZE, 5*l.*, for "Hard to Find," brown mare; foaled in 1883; breeder unknown; *s.* "Reality," *d.* by "Confidence."

CATTLE.

Shorthorn.

Class 50.—*Shorthorn Bulls calved in either* 1883 *or* 1884.
[9 entries.]

547 ALEXANDER MORRISON GORDON, Newton, Insch, Aberdeenshire: FIRST PRIZE, 20*l.*, and the CHAMPION PRIZE, 20*l.*,[1] for "Mario" (51713), roan; was calved February 24, 1884; bred by Mr. W. Duthie, Collynie, Tarves, Aberdeenshire; *s.* "Field Marshal" (47870); *d.* "Mina 3rd," by "Border Chief" (37874); *g. d.* "Mina," by "Lord Irwin" (29123); *gr. g. d.* "Mayflower," by "Vampire" (30201); *gr. g. g. d.* "Mary," by "Lord Raglan" (29199).

[1] Given by the Shorthorn Society for the best Male Shorthorn.

549 CHARLES WILLIAM BRIERLEY, Rosedale, Tenbury, Worcestershire: SECOND PRIZE, 10*l.*, for "Ruckley," white; was calved May 23, 1883; bred by the late Mr. S. L. Horton, Park House, Shifnal, Shropshire: *s.* "Prince Saturn" (46926); *d.* "Constance Doon," by "Marquis of Blandford 6th" (41983); *g. d.* "Lorna Doon," by "Abacot" (32900); *gr. g. d.* "Ellie," by "Prince Albert" (18579); *gr. g. g. d.* "Rose of Midsummer," by "Sir Colin" (15276).

548 RICHARD STRATTON, The Duffryn, Newport, Monmouthshire: THIRD PRIZE, 5*l.*, for "Pilot" (51837); white: was calved November 17, 1884; bred by himself; *s.* "Acropolis" (47316); *d.* "Primula," by "Crowned Victor" (36408); *g. d.* "Prima," by "James I." (24202); *gr. g. d.* "Miranda," by "Knight of the Lagan" (20082); *gr. g. g. d.* "Moss Rose 4th," by "Hickory" (14706).

550 CHARLES WILLIAM BRIERLEY, Rosedale: the *Reserve Number*, for "Aristocrat" (50766), roan; was calved February 5, 1884; bred by Mr. G. W. Lambart, Beau Parc, Meath; *s.* "Nobleman 2nd," (48363), *d.* "Albatross," by "Jupiter" (38477): *g. d.* "Alba," by "Rupert" (29920); *gr. g. d.* "Anglia," by "British Sailor" (23472); *gr. g. g. d.* "Glory," by "Royal Standard" (40644).

Class 51.—*Shorthorn Bulls calved in the Year* 1885. [11 entries.]

561 ROBERT THOMPSON, Inglewood, Penrith, Cumberland: FIRST PRIZE, 20*l.*, and the *Reserve Number* for CHAMPION PRIZE,[1] for "Master Shapely" (53292), roan: was calved January 16; bred by himself; *s.* "Beau Benedict" (42769); *d.* "Shapely," by "Brilliant Butterfly" (36270): *g. d.* "Sweetly," by "Grand Duke of Fawsley 3rd" (31286); *gr. g. d.* "Smartly," by "Marquis of Cobham" (22299): *gr. g. g. d.* "Sprightly," by "Tweedside" (12246).

562 JOHN HANDLEY, Green Head, Milnthorpe, Westmoreland: SECOND PRIZE, 10*l.*, for "Macbeth" (54676); red, and little white: was calved, April 30: bred by Mr. J. A. Gordon, Arabella, Nigg Station, Ross-shire; *s.* "Macgregor" (50001); *d.* "Bessie Bell," by "Rosario," (35315); *g. d.* "Betty Butterfly," by "Butterfly Charlie" (28111): *gr. g. d.* "Betty," by "Mars" (29307); *gr. g. g. d.* "Lady Love," by "Gold Nugget" (16176).

557 SIR HUMPHREY FRANCIS DE TRAFFORD, Bart., Trafford Park, Manchester: THIRD PRIZE, 5*l.*, for "Melton," roan; was calved June 23; bred by Mr. Edward Pease, The Crundalls, Bewdley, Worcestershire; *s.* "Earl of Aylesby 4th" (46291): *d.* "Park Nellie 3rd," by "Foster Brother" (36661); *g. d.* "Nellie," by "Chieftain" (20942); *gr. g. d.* "Helen," by "Field Marshal" (16044): *gr. g. g. d.* "Bessy," by "Apollo" (9898).

558 RICHARD BROWN, Ruyton of the Eleven Towns, Shropshire: the *Reserve Number* and *Highly Commended*, for "Silkie Lad," red and white; was calved February 17; bred by Mr. J. Humphreys, Hanley Hall, West Felton, Shropshire; *s.* "Sealskin" (52122); *d.* "Winter Rose," by "Broderick" (33234); *g. d.* "Woodbine," by "Arrogance" (17321); *gr. g. d.* "Winter Rose," by "Cormorant" (12540); *gr. g. g. d.* "Wanton," by "Valiant" (7662).

Nos. 563 and 564 were *Commended.*

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[1] Given by the Shorthorn Society for the best Male Shorthorn.

Class 52.—*Shorthorn Bulls calved in the Year* 1886. [16 entries.]

576 JOHN HANDLEY, Green Head, Milnthorpe: FIRST PRIZE, 20*l.*, for "Self Conceit" (55026), red, and little white; was calved February 26; bred by Mr. W. Handley, Green Head; *s.* "Self Esteem 2nd" (48675); *d.* "Derwent Queen," by "Baron Stackhouse" (30488); *g. d.* "Derwent Lady 2nd," by "Vice Roi" (30214); *gr. g. d.* "Derwent Lady," by "The Premier" (27640); *gr. g. g. d.* by "Baron Killerby" (23364).

571 JOHN MASKILL, Warren House, Brandsby, Easingwold, Yorkshire: SECOND PRIZE, 10*l.*, for "Royal Saxon," red and white; was calved March 2; bred by Mr. E. Tindall, Knapton Hall, Rillington, Yorkshire; *s.* "Blairmore" (49156); *d.* "Derwent Queen 2nd," by "Sampiero" (35466); *g. d.* "White Thorn," by "Cecil" (25725); *gr. g. d.* "Miss Wiley," by "Cavendish" (15745); *gr. g. g. d.* "Miss Spearman," by "Sir Charles" (16949).

569 JOSEPH THOMPSON, Elswick, Poulton-le-Fylde, Lancashire: THIRD PRIZE, 5*l.*, for "Fylde Ingram" (54333), red and white; was calved July 3; bred by Mr. T. Shaw, The Island, Winmarleigh, Garstang, Lancashire; *s.* "Royal Ingram" (50374); *d.* "Diana 8th," by "Romulus" (45487); *g. d.* "Diana 5th," by Valentine's "Duke of Claro" (40844); *gr. g. d.* "Diana 2nd," by "Grand Duke of Oxford 3rd" (31295); *gr. g. g. d.* "Diana," by "Prince of Lancaster" (22616).

575 JOHN HANDLEY, Green Head: the *Reserve Number* and *Highly Commended*, for "Golden Treasure 2nd" (54378), roan; was calved August 5; bred by Mr. W. Handley, Green Head; *s.* "Golden Treasure" (51346); *d.* "Red Rose of Green Head," by "Master Harbinger" (40324); *g. d.* "Red Rose of Dingley 2nd," by "Earl of Waterloo 2nd" (33819); *gr. g. d.* "Dewdrop," by "Lord Chatham" (26625); *gr. g. g. d.* "Dairy Lass," by "Birthday" (19313).

Nos. 572 and 574 were *Commended.*

Class 53.—*Shorthorn Bulls calved in the Year* 1887. [47 entries.]

603 ROBERT PINDER, Whitwell, Oakham, Rutlandshire: FIRST PRIZE, 20*l.*, for "Royal Fieldsman," red and white; was calved May 23; bred by himself; *s.* "Wallace" (48899); *d.* "Victoria Graceful," by "M.C." (31898); *g. d.* "Victoria Pulcherima," by "Bythis" (25700); *gr. g. d.* "Victoria Pulchra," by "Charles le Beau" (23542); *gr. g. g. d.* "Victoria Rubicunda," by "Ravenspur" (20628).

618 LORD POLWARTH, Mertoun House, St. Boswells, N.B.: SECOND PRIZE, 10*l.*, for "Ironclad," roan; was calved February 8; bred by himself; *s.* "King Alfonso" (49803); *d.* "Wave Surf," by "Knight of Knowlmere 2nd" (31542); *g. d.* "Wave Foam," by "Manfred" (26801); *gr. g. d.* "Wave Breast," by "Breast Plate" (19337); *gr. g. g. d.* "Wave Princess," by "British Prince" (14197).

612 JOHN HANDLEY, Green Head, Milnthorpe: THIRD PRIZE, 5*l.*, for "Roseberry," white; was calved February 19; bred by Lord Lovat, Beaufort Castle, Beauly, N.B.; *s.* "Bannockburn" (49035); *d.* "Groam Duchess," by "Duke of Beaufort" (38122); *g. d.* "Beaufort Rose 1st," by "Highland Chief" (38431); *gr. g. d.* "Beaufort Rose," by "Bachelor of Arts" (32982); *gr. g. g. d.*, by "Champion of England" (17526).

583 H.R.H. THE PRINCE OF WALES, K.G., Sandringham, Norfolk: the *Reserve Number* and *Highly Commended*, for "Dauntless," red and white; was calved March 1; bred by His Royal Highness; *s.* "Fitz-

Mowbray" (49591); *d.* "Diadem 18th," by "Baron Wolferton" (44387): *g. d.* "Diadem 3rd," by "Royal Dublin" (35354); *gr. g. d.* "Diadem," by "Fawsley Prince" (31150); *gr. g. g. d.* "Diamond," by "The Chieftain" (20942).

Nos. 595, 600, and 627 were *Highly Commended.*

Nos. 590, 596, 604, and 606 were *Commended.*

Class 54.—*Shorthorn Cows, in-milk or in-calf, calved previously to or in the Year* 1884. [10 entries.]

633 ROBERT THOMPSON, Inglewood, Penrith, Cumberland: FIRST PRIZE, 20*l.*, for "Molly Millicent," roan; was calved June 11, 1884; in-milk; calved March 16, 1888, and in-calf; bred by himself; *s.* "Beau Benedict" (42769); *d.* "Fair Millicent 2nd," by "Brilliant Butterfly" (36270); *g. d.* "Fair Millicent," by "Grand Duke of Fawsley 3rd" (31286); *gr. g. d.* "Moss Rose 4th," by "Royal Gwynne" (22784); *gr. g. g. d.* "Moss Rose," by "Lord of Brawith" (10465).

635 WILLIAM HOSKEN & SON, Loggans Mill, Hayle, Cornwall: SECOND PRIZE, 10*l.*, for "Alexandria 9th," roan; was calved January 2, 1884; in-milk; calved May 11, 1888; bred by themselves; *s.* "Grand Duke of Oxford 5th" (43318); *d.* "Alexandria 5th," by "Prince of Oxford" (42212); *g. d.* "Alexandria," by "Earl of Oxford 2nd" (23844); *gr. g. d.* "Maid of Athens," by "Sir Richard" (15298); *gr. g. g. d.* "Miss Bloomer," by "Siddington Duke" (15263).

634 ALFRED E. W. DARBY, Little Ness, Shrewsbury: THIRD PRIZE, 5*l.*, for "Lady Leodine," white; was calved November 20, 1881; in-milk; calved April 8, 1888; bred by himself; *s.* "King Harold" (40053); *d.* "Leodine 4th," by "Sir Windsor Broughton" (27507); *g. d.* "Leodine," by "King Charles" (24240); *gr. g. d.* "Lady Jane," by "Killerby Lad" (20052); *gr. g. g. d.* "Lady Margaret," by "Field Mate" (16045).

632 CHARLES WILLIAM BRIERLEY, Rosedale, Tenbury, Worcestershire: the *Reserve Number* and *Highly Commended*, for "Lady Worsley," roan; was calved December 2, 1883; in-milk; calved June 14, 1888; bred by Mr. J. Rowley, Vine Cottage, Norton, Doncaster; *s.* "Self Esteem 2nd" (48675); *d.* "Dewdrop," by "Paul Potter" (38854); *g. d.* "Irwin's Rose," by "Lord Irwin" (29133); *gr. g. d.* "Lady Irwin," by "Lord Albert" (20143); *gr. g. g. d.* "Fragrance," by "Mountain Chief" (20383).

No. 636 was *Highly Commended.*

No. 637 was *Commended.*

Class 55.—*Shorthorn Cows or Heifers, in-milk or in-calf, calved in the Year* 1885. [10 entries.]

644 ROBERT THOMPSON, Inglewood, Penrith: FIRST PRIZE, 20*l.*, and the *Reserve Number* for CHAMPION PRIZE,[1] for "Inglewood Gem," roan; was calved September 14; in-milk; calved March 15, 1888, and in-calf: bred by himself; *s.* "Royal Baron" (50354); *d.* "Inglewood Belle," by "Beau Benedict" (42769); *g. d.* "Inglewood Pet," by "Brilliant Butterfly" (36270); *gr. g. d.* "Love Token," by "Grand Duke of Fawsley 3rd" (31286); *gr. g. g. d.* "Farewell," by "Royal Westmoreland" (35416).

[1] Given by the Shorthorn Society for the best Female Shorthorn.

641 Charles William Brierley, Rosedale, Tenbury: Second Prize, 10*l.*, for "Ancient Fashion," roan; was calved December 19; in-calf [1]; bred by Mr. R. Jefferson, Preston Hows, Whitehaven; *s.* "Young Albion" (48999); *d.* "Apricot," by "Regan" (45462); *g. d.* "Kate," by "British Boy" (30597); *gr. g. d.* "Louisa 7th," by "Hæmatite" (31332); *gr. g. g. d.* "Louisa 6th," by "Comet" (21449).

643 Charles William Brierley: Third Prize, 5*l.*,[1] for "Victoria," roan; was calved October 27; in-calf [calved Oct. 2, 1888]; bred by Earl Spencer, K.G., Althorp Park, Northamptonshire; *s.* "Darnley" (47678); *d.* "Cowslip," by "Javelin" (46530); *g. d.* "Queen of the May," by "Prince Rufus" (35177); *gr. g. d.* "Forest Queen," by "Duke of Wateringbury" (23799); *gr. g. g. d.* "Jewel," by "Ridlington" (22726).

642 Charles William Brierley: the *Reserve Number* [1] and *Highly Commended*, for "Waterloo Cherry 13th," red and white; was calved June 12; in-milk; calved January 4, 1888; bred by the late Mr. E. Grey, Eastham, Cheshire; *s.* "Duke of Certainty" (47719); *d.* "Waterloo Cherry 12th," by "Prince Saturn" (46926); *g. d.* "Waterloo 9th," by "Marquis of Blandford" (41983); *gr. g. d.* "Waterloo Cherry 4th," by "Ideal" (31404); *gr. g. g. d.* "Waterloo Cherry," by "Kirbythore Waterloo" (24263).

No. 649 was *Highly Commended.*

Nos. 645 and 648 were *Commended.*

Class 56.—*Shorthorn Heifers calved in the Year* 1886. [18 entries.]

657 Robert Thompson, Inglewood, Penrith, Cumberland: First Prize, 20*l.*, and the Champion Prize of 25*l.*,[2] for "Belle Madeline," roan; was calved August 21; bred by himself; *s.* "Beau Benedict" (42769); *d.* "Madeline Butterfly," by "Major Benedict" (41959); *g. d.* "Ruby Butterfly," by "Banner Bearer" (27907); *gr. g. d.* "Phœbe Butterfly," by "Duke of Wharfdale" (19648); *gr. g. g. d.* "Double Butterfly," by "Royal Butterfly" (16862).

655 Bridgman Langdale Barrow, Sydnope Hall, Matlock, Derbyshire: Second Prize, 10*l.*, for "Fairy Duchess 11th," roan; was calved June 9; bred by himself; *s.* "Grand Duke 46th" (49671); *d.* "Fairy Duchess 4th," by "Duke of Oxford 50th" (43121); *g. d.* "Violet," by "The Bursar" (35742); *gr. g. d.* "Daffodil," by "Duke of Oxford 11th" (19632); *gr. g. g. d.* "Young Daisy," by "Zadig" (8796).

650 Her Majesty the Queen, The Prince Consort's Shaw Farm, Windsor: Third Prize, 5*l.*, for "Roan Lady 14th," roan; was calved March 15; in-calf; bred by Mr. W. S. Marr, Uppermill, Tarves, Aberdeenshire; *s.* "Athabasca" (47359); *d.* "Roan Lady 5th," by "Cherub 4th" (33359); *g. d.* "Red Lady 2nd," by "Heir of Englishman" (24122); *gr. g. d.* "Red Lady," by "Young Pacha" (20457); *gr. g. g. d.* "Roan Lady," by "Son of Young Ury" (10984).

656 Charles William Brierley, Rosedale, Tenbury: the *Reserve Number* and *Highly Commended*, for "Rosedale Grace," white; was calved December 2; bred by himself; *s.* "Madrigal" (51694); *d.* "Rosedale

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[1] "Ancient Fashion" having thrown her calf on the Wednesday of the Nottingham Meeting, and having thus become ineligible for a Prize, the Second Prize of 10*l.* has been awarded to "Victoria," and the Third Prize of 5*l.* to "Waterloo Cherry 13th."

[2] Given by the Shorthorn Society for the best Female Shorthorn.

Nun," by "Rosedale Oxford" (48597); *g. d.* "Snowflake," by "Bolivar's Farewell" (33173); *gr. g. d.* "Bolivar's White Tulip," by "Bolivar" (25649); *gr. g. g. d.* "Tulip Flower," by "Lord Albert" (20143).

Class 57.—*Shorthorn Heifers, calved in the Year* 1887. [37 entries.]

685 Robert Thompson, Inglewood, Penrith: First Prize, 20*l.*, for "Pearl Bangle," roan; was calved March 9; bred by himself; *s.* "Royal Baron" (50354); *d.* "Pearl Armlet," by "Beau Benedict" (42769); *g. d.* "Pearl Necklace 2nd," by "Hubback Junior" (31395); *gr. g. d.* "Pearl Necklace," by "Wild Boy" (25447); *gr. g. g. d.* "Pearl Powder," by "Grand Duke 9th" (19879).

683 Thomas Stokes, Home Farm, Warmington, Oundle, Northamptonshire: Second Prize, 10*l.*, for "Gladys' Rose," red; was calved May 2; bred by himself; *s.* "Gladys' Hero" (52940); *d.* "Wild Rose," by "Duke Wild Eyes 2nd" (43155); *g. d.* "Moss Rose," by "Grand Duke of Darlington 2nd" (41647); *gr. g. d.* "May Rose," by "Lord Chancellor" (20160); *gr. g. g. d.* "May Flower," by "King of the Forest" (24254).

696 The Duke of Portland, Clipstone Park Farm, Mansfield, Nottinghamshire: Third Prize, 5*l.*, for "Georgina 7th," white; was calved January 16; bred by exhibitor; *s.* "Wanderer" (50622); *d.* "Georgina 4th," by "Grand Ruth" (46459); *g. d.* Georgina 2nd," by "Cleveland" (33396); *gr. g. d.* "Georgina," by "Vesuvius" (21017); *gr. g. g. d.* "Gertrude," by "Beppo" (15644).

679 Charles William Brierley, Rosedale, Tenbury: the *Reserve Number* and *Highly Commended*, for "Rosedale Graceful," white; was calved January 16; bred by himself; *s.* "Buckley" (50398); *d.* "Rosedale Snowflake," by "Rosedale Oxford" (48597); *g. d.* "Snowflake," by "Bolivar's Farewell" (33173); *gr. g. d.* "Bolivar's White Tulip," by "Bolivar" (25649); *gr. g. g. d.* "Tulip Flower," by "Lord Albert" (20143).

No. 693 was *Highly Commended.*

Nos. 670, 675, 680, 689, 695, 698, and 699 were *Commended.*

Hereford.

Class 58.—*Hereford Bulls, calved in either* 1883 *or* 1884. [7 entries.]

708 Henry William Taylor, Showle Court, Ledbury, Herefordshire: First Prize, 20*l.*, for "Maidstone" (8875); was calved April 20, 1883; bred by himself; *s.* "Franklin" (6961); *d.* "Duchess 4th," by "Tredegar" (5077); *g. d.* "Duchess," by "Twin" (2284); *gr. g. d.* "Duchess," by "Alma" (1144); *gr. g. g. d.* "Victoria," by "Prince Albert" (686).

705 The Earl of Coventry, Croome Court, Severn Stoke, Worcestershire: Second Prize, 10*l.*, for "Rare Sovereign" (10499); was calved February 19, 1884; bred by himself; *s.* "Good Boy" (7668); *d.* "Rare Jewel," by "Merry Monarch" (5466): *g. d.* "Rarity 14th," by "Archduke" (4312); *gr. g. d.* "Rarity 3rd," by "Silver Prince" (5583); *gr. g. g. d.* "Rarity," by "Conqueror" (1929).

707 Richard Edwards, The Sheriffs, Lyonshall, Kington, Herefordshire; Third Prize, 5*l.*, for "Magnet" (8873); was calved July 7, 1883; bred by himself; *s.* "Marquis" (6057); *d.* "Broken Horn 4th," by "Commander" (4452); *gr. d.* "Old Broken Horn," by "Governor" (3137); *gr. g. d.* "Peach," by "Pollox" (2163); *gr. g. g. d.* "Peach," by "Pilot" (1036).

710 WILLIAM THOMPSON CRAWSHAY, Cyfarthfa Castle, Merthyr Tydfil, Glamorganshire: the *Reserve Number* and *Highly Commended*, for "Stockton Prince" (10688); was calved April 8, 1884; bred by the late Mr. T. J. Carwardine, Stocktonbury, Leominster, Herefordshire; *s.* "Lord Wilton" (4740); *d.* "Ruth," by "Rodney" (4907); *g. d.* "Bella," by "De Cote" (3060); *gr. g. d.* "Charity," by "Heart of Oak" (2035); *gr. g. g. d.* "Luna," by "Counsellor" (1939).

Class 59.—*Hereford Bulls, calved in the Year* 1885. [4 entries.]

712 WILLIAM HYDE COOKE, The Green, Shelsley Kings, Worcester: FIRST PRIZE, 20*l.*, and the *Reserve Number* for CHAMPION PRIZE,[1] for "Grove Wilton 3rd"; was calved March 16; bred by himself; *s.* "Lord Wilton" (11295); *d.* "Polyanthus," by "The Grove 3rd" (5051), *g. d.* "Promise," by "Dauphin" (3058); *gr. g. d.* "Primrose," by "Bachelor" (2941); *gr. g. g. d.* "Violet," by "Bolingbroke" (1883).

713 THE EARL OF COVENTRY, Croome Court, Severn Stoke: SECOND PRIZE' 10*l.*, for "Rondeau;" was calved February 25; bred by himself; *s.* "Minstrel" (8915); *d.* "Rhodia 4th," by "Spartan" (5009); *g. d.* "Rhodia," by "Subaltern" (2794); *gr. g. d.* "Norma," by "Bolingbroke" (1883); *gr. g. g. d.* "Carissima," by "Felix" (953).

715 REES KEENE, Pencraig, Caerleon, Monmouthshire: THIRD PRIZE, 5*l.* for "Three R's;" was calved May 4; bred by himself; *s.* "Bangham" (6793), *d.* "Jeffrey 7th," by "Lord Waterford" (6045); *g. d.* "Jeffrey 6th," by "Dulas" (3079); *gr. g. d.* "Jeffrey 2nd," by "Garrick Junior" (2532), *gr. g. g. d.* "Old Jeffrey," by "Sovereign" (404).

714 THE EARL OF COVENTRY, Croome Court: the *Reserve Number* and *Highly Commended*, for "Textuary;" was calved January 28; bred by himself; *s.* "Good Boy" (7668); *d.* "Tulip 8th," by "Monkton Lad" (5646); *g. d.* "Tulip 5th," by "Triumph 2nd" (3553); *gr. g. d.* "Tulip 3rd," by Sir Frank (2762); *gr. g. g. d.* "Tulip 2nd," by "France" (1993).

Class 60.—*Hereford Bulls, calved in the Year* 1886. [4 entries.]

719 JOHN PRICE, Court House, Pembridge, Herefordshire: FIRST PRIZE, 20*l.*, and the CHAMPION PRIZE of 20*l.*,[1] for "Prince Alfred;" was calved April 26; bred by himself; *s.* "Monarch" (7858); *d.* "Playful," by "Hotspur" (7028); *g. d.* "Plum 5th," by "Grand Duke" (5342); *gr. g. d.* "Plum," by "Horace" (3877), *gr. g. g. d.* "Plum," by "North Star" (2134).

716 THE EARL OF COVENTRY, Croome Court: SECOND PRIZE, 10*l.*, for "Golden Miner;" was calved March 22; bred by himself; *s.* "Californian" (8355); *d.* "Golden Dream," by "Fisherman" (5913), *g. d.* "Golden Treasure," by "Maréchal Niel" (4760); *gr. g. d.* "Giantess," by "Sir Roger" (4133), *gr. g. g. d.* "Haidee," by "Battenhall" (2406).

718 HENRY WILLIAM TAYLOR, Showle Court, Ledbury, Herefordshire: the *Reserve Number* and *Highly Commended*, for "Sarchedon" (12656); was calved August 27; bred by himself; *s.* "Maidstone" (8875), *d.* "Fairy," by "Thoughtful" (5063); *g. d.* "Hazel," by "Tom Brown" (2828); *gr. g. d.* "Hazel," by "Holmer" (2043); *gr. g. g. d.* "Hazel," by "Showle" (1384).

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[1] Given by FREDERICK PLATT, Esq., High Sheriff of the County of Nottingham, for the best animal in the Hereford Classes.

Class 61.—*Hereford Bulls, calved in the Year* 1887. [9 entries.]

720 Allen Edwards Hughes, of Wintercott, Leominster, Herefordshire: First Prize, 20*l.*, for "Royal Head;" was calved January 9; bred by himself; *s.* "Cheerful" (6351); *d.* "Beauty," by "Garfield 2nd" (7648); *g. d.* "Beatrice 2nd," by Royalist" (4921); *gr. g. d.* "Brownmaid 2nd," by "Tomboy" (3546); *gr. g. g. d.* "Brownmaid," by "Pompey" (2683).

724 Thomas Fenn, Stonebrook House, Ludlow: Second Prize, 10*l.*, for "Downton Wilton;" was calved February 3; bred by himself; *s.* "Viscount Wilton" (11824); *d.* "Hermione," by "King of the Lilies" (3892); *g. d.* "Queen of Hearts," by "Matchless" (2110); *gr. g. d.* "Nelly," by "Sir Colin" (2216); *gr. g. g. d.* by "Ben Bolt" (1871).

721 The Earl of Coventry, Croome Court: Third Prize, 5*l.*, for "Royal Ruler;" was calved March 27; bred by himself; *s.* "Rare Sovereign" (10499), *d.* "Rosemary," by "Grove 3rd" (5051); *g. d.* "Rhodia 4th," by "Spartan" (5009); *gr. g. d.* "Rhodia," by "Subaltern" (2794); *gr. g. g. d.* "Norma," by "Bolingbroke" (1883).

726 Henry William Taylor, Showle Court, Ledbury: the *Reserve Number* and *Highly Commended,* for "Royal Dublin;" was calved January 3; bred by himself; *s.* "Maidstone" (8875); *d.* "Patience," by Franklin" (6961); *g. d.* "Hazel 4th," by "Triumph 2nd" (3553); *gr. g. d.* "Hazel," by "Tom Brown" (2828); *gr. g. g. d.* "Hazel," by "Holmer" (2043).

Nos. 722, 725, and 727 were *Commended.*

Class 62.—*Hereford Cows or Heifers, in-milk, or in-calf, calved previously to or in the Year* 1884. [7 entries.]

735 Sir Joseph Layton Elmes Spearman, Bart., of Llansannor Court, Cowbridge, Glamorganshire: First Prize, 20*l.*, for "Myrtle 6th;" was calved June 2, 1880; in-milk; calved June 20, 1887; bred by Mr. S. Goode, Ivingtonbury, Leominster; *s.* "Embassador" (4551); *d.* "Myrtle 4th," by "Blucher" (2964); *g. d.* "Myrtle 3rd," by "Albert" (2921), *gr. g. d.* "Myrtle 2nd," by "Pompey" (2683); *gr. g. g. d.* "Myrtle," by "Demetrius" (2494).

729 Her Majesty The Queen, Flemish Farm, Windsor: Second Prize, 10*l.*, for "Mabelle;" was calved July 18, 1881; in-calf; bred by the late Mr. T. J. Carwardine, Stocktonbury, Leominster; *s.* "Lord Wilton" (4740); *d.* "Charity 2nd," by "Longhorns" (4711); *g. d.* "Charity," by "Heart of Oak" (2035); *gr. g. d.* "Luna," by "Counsellor (1939); *gr. g. g. d.* "Picture," by "Sir Thomas" (2228).

734 James Rankin, M.P., Bryngwyn, Tram Inn, R.S.O., Herefordshire: Third Prize, 5*l.*, for "Fortune-teller," was calved March 23, 1884; in-milk; calved April 5, 1888; bred by himself; *s.* "Pirate" (6105); *d.* "Gipsy," by "The Grove 3rd" (5051); *g. d.* "Trinket," by "Spartan" (5009); *gr. g. d.* "Garnett," by "Vanguard" (5100); *gr. g. g. d.* "Amethyst," by "Provost" (4067).

731 William Tudge, Leinthall, Ludlow: the *Reserve Number* and *Highly Commended,* for "Bella;" was calved January 23, 1883; in-milk; calved May 20, 1888; bred by himself; *s.* "Auctioneer" (5194); *d.* "Belladonna," by "Orleans" (2661); *g. d.* "Bonnie," by "Carbonel" (1525); *gr. g. d.* "Beauty 2nd," by "Young Walford (1820); *gr. g. g. d.* "Beauty," by "Nelson" (1021).

No. 733 was *Commended.*

Class 63.—*Hereford Cows or Heifers, in-milk, or in-calf, calved previously to or in the Year* 1885. [5 entries.]

740 Henry William Taylor, Showle Court, Ledbury, Herefordshire: First Prize, 20*l.*, for "Cardiff Lass 2nd"; was calved January 5, 1885; calved June 2, 1888; bred by himself; *s.* "Franklin" (6961); *d.* "Cardiff Lass," by "Emperor" (5890); *g. d.* "Modesty," by "Tredegar" (5077); *gr. g. d.* "Lovely," by "Tenant Farmer" (2806); *gr. g. g. d.* "Blossom," by "Twin" (2284).

736 Ralph Palmer, Lodge Farm, Nazeing, Waltham Cross, Essex: Second Prize, 10*l.*, for "Lightfoot;" was calved June 23, 1885; in-milk; calved January 1, 1888, and in-calf; bred by himself; *s.* "Rosestock" (6651); *d.* "Lillian," by "Rodney" (4907); *g. d.* "Lilac," by "De Cote" (3060); *gr. g d.* "Fanny," by "Heart of Oak" (2035); *gr. g. g. d.* "Alethea," by "Sir John 2nd" (3455).

738 Colonel Robert Bridgford, Kinnersley, Letton, R.S.O., Herefordshire: Third Prize, 5*l.*, for "Princess;" was calved June 5, 1885; in-milk; calved February 25, 1888; bred by himself; *s.* "Regulator" (6637); *d.* "Victoria 2nd," by "Regulus" (4076); *g. d.* "Victoria," by "Berrington (2414); *gr. g. d.* "Princess Royal," by "Sir Thomas" (2428); *gr. g. g. d.* "Prize Flower," by "Arthur Napoleon" (918).

737 The Earl of Coventry, Croome Court, Severn Stoke: the *Reserve Number* and *Highly Commended*, for "Rare Gem;" was calved January 13, 1885; in-milk; calved March 22, 1888; bred by himself; *s.* "Good Boy" (7668); *d.* "Rare Jewel," by "Merry Monarch" (5466); *g. d.* "Rarity 14th," by "Archduke" (4312); *gr. g. d.* "Rarity 3rd," by "Silver Prince (5583); *gr. g. g. d.* "Rarity," by "Conqueror" (1929).

No. 739 was *Highly Commended.*

Class 64.—*Hereford Heifers, calved in the Year* 1886. [5 entries.]

742 The Earl of Coventry, Croome Court, Severn Stoke: First Prize, 10*l.*, for "Rosewater;" was calved February 27; bred by himself; *s.* "Rare Sovereign" (10499); *d.* "Rosemary," by "The Grove 3rd," (5081); *g. d.* "Rhodia 4th," by "Spartan" (5009); *gr. g. d.* "Rhodia," by "Subaltern" (2794); *gr. g. g. d.* "Norma," by "Bolingbroke" (1883).

743 John Hungerford Arkwright, Hampton Court, Leominster, Herefordshire: Second Prize, 10*l.*, for "Ivington Lass 24th;" was calved January 1; bred by himself; *s.* "Rose Cross" (7237); *d.* "Ivington Lass 5th," by "Concord" (4458); *g. d.* "Ivington Lass 2nd," by "Sir Richard" (3460); *gr. g. d.* "Ivington Lass," by "Dan O'Connell" (1952); *gr. g. g. d.* by "Mortimer" (1328).

744 William Tudge, Leinthall, Ludlow: Third Prize, 5*l.*, for "Lady Wilton;" was calved January 6; bred by himself; *s.* "Lord Wilton" (4740); *d.* "Cherry Blossom," by "Downton Boy" (5877); *g. d.* "Cherry," by "Sultan" (4163); *gr. g. d.* "Cherry," by "Prince Charles" (4041); *gr. g. g. d.* "Cherry," by "Vron End" (9372).

745 William Thompson Crawshay, Cyfarthfa Castle, Merthyr Tydfil, Glamorganshire: the *Reserve Number*, for "Cyfarthfa Violet 2nd;" was calved July 25; bred by himself; *s.* "Stockton Prince" (10688); *d.* "Downton Violet," by "Downton Boy" (5877); *g. d.* "Violet," by "Grandee" (5344); *gr. g. d.* "Stockwell," by "Stockwell" (2792); *gr. g. g. d.* "Violet 2nd," by "Trooper" (2838).

Class 65.—*Hereford Heifers, calved in the Year* 1887. [12 entries.]

753 REES KEENE, Pencraig, Caerleon, Monmouthshire: FIRST PRIZE, 20*l.*, for "Blanche Bangham;" was calved January 11; bred by himself; *s.* "Bangham" (6793); *d.* "Blanche 2nd," by "Return" (6639); *g. d.* "Lady Farewell," by "Cheerful" (5254); *gr. g. d.* "Lady Blanche," by "Von Moltke 2nd" (4234); *gr. g. g. d.* "Fairmaid," by "Prince Alfred" (3342).

748 ALLEN EDWARDS HUGHES, Wintercott, Leominster: SECOND PRIZE, 10*l.*, for "Princess;" was calved February 22; bred by himself; *s.* "Cheerful" (6351); *d.* "Newtown Plum," by "Rudolph" (6660); *g. d.* "Plum 3rd," by "Commander" (4452); *gr. g. d.* "Plum," by "Comet" (2469); *gr. g. g. d.* "Gem," by "Adforton" (1839).

747 HER MAJESTY THE QUEEN, Flemish Farm, Windsor: THIRD PRIZE, 5*l.*, for "Belle," was calved January 26; bred by Her Majesty; *s.* "Constantine" (9750); *d.* "Bonny Lass," by "Hotspur" (7028); *g. d.* "Blowdy," by "Grand Duke" (5342); *gr. g. d.* "Blowdy," by "Horace" (3877); *gr. g. g. d.* "Blowdy," by "Paragon" (2665).

746 HER MAJESTY THE QUEEN, Flemish Farm: the *Reserve Number* and *Highly Commended*, for "Phyllis;" was calved January 15; bred by Her Majesty; *s.* "Horatius" (5390); *d.* "Princess Victoria," by "Conqueror" (7510); *g. d.* "Princess Elizabeth," by "Prince Leopold" (3351); *gr. g. d.* "Victoria II.," by "Ajax" (1843); *gr. g. g. d.* "Adela," by "Will o' the Wisp" (1454).

Nos. 749, 750, 751, 752, 754, 756, and 757 were *Highly Commended.*

Class 66.—*Hereford Bull and two Heifers, all calved in the Year* 1887.[1] [4 entries.]

758 HENRY FREEMAN RUSSELL, Westonbury, Pembridge, Herefordshire: FIRST PRIZE, 20*l.*, for "Sir William;" was calved March 12; *s.* "Horace Hardwick" (8748); *d.* "Lady Nancy," by "Horatius" (5390); *g. d.* "Lady Hilda," by "Colorado" (5257). "Dorothy;" was calved January 22; *s.* "Horace Hardwick" (8748); *d.* "Favourite 2nd," by "Corporal" (5845); *g. d.* "Favourite," by "Bismarck" (3689). "Queen Bess;" was calved April 13; *s.* "Horace Hardwick" (8748); *d.* "Whim," by "Horatius" (5390); *g. d.* "Whiteback 2nd," by "Remus" (5535); all bred by himself.

760 STEPHEN ROBINSON, Lynhales, Kington, Herefordshire: SECOND PRIZE, 10*l.*, for "First Fruits;" was calved April 14; *s.* "Highland Laird" (7015); *d.* "Princess Beatrice 2nd," by "Rose Stock" (6651); *g. d.* "Princess Beatrice," by "Treasure Trove" (5014). "White Spark 6th;" was calved January 3; *s.* "Rose Stock" (6651); *d.* "White Spark 3rd," by "Horatius" (5390); *g. d.* "White Spark," by "Regulus" (4076). "Red Spark 6th;" was calved January 13; *s.* "Rose Stock" (6651); *d.* "Red Spark 2nd," by "Horatius" (5390); *g. d.* "Red Spark," by "Regulus" (4076); all bred by himself.

759 ARTHUR PHILIP TURNER, The Leen, Pembridge, Herefordshire: the *Reserve Number* and *Highly Commended*, for "Salisbury;" was calved January 20; *s.* "Sir Edward" (10631); *d.* "Promise 3rd," by "Pirate" (6105); *g. d.* "Agnes," by "Jupiter" (3191). "Beatrice"

[1] Prizes given by the Hereford Herd Book Society.

was calved February 2; *s.* "Sir Edward" (10631); *d.* "Blossom," by "Pirate" (6105); *g. d.* "Sunflower," by "Spartan" (5009). "Veronica" was calved March 9; *s.* "Sir Edward" (10631); *d.* "Venus 3rd," by "The Grove 3rd" (5051); *g. d.* "Venus," by "Spartan" (5009); all bred by himself.

No. 761 was *Highly Commended.*

Devon.

Class 67.—*Devon Bulls, calved in either* 1883, 1884, 1885, *or* 1886. [7 entries.]

763 VISCOUNT FALMOUTH, Tregothnan, Probus, Cornwall: FIRST PRIZE, 20*l.*, for "Lord Wolseley" (2063); was calved January 8, 1884; bred by himself; *s.* "Cairo" (1690); *d.* "Remembrance" (3882), by "Cinnamon" (1039); *g. d.* "Photograph" (3758), by "Sunflower" (937); *gr. g. d.* "Picture 4th" (2224), by "Napoleon 3rd" (464); *gr. g. g. d.* "Picture" (337).

766 ALFRED C. SKINNER, Pound Farm, Bishop's Lydeard, Somersetshire: SECOND PRIZE, 10*l.*, for "General Gordon" (1974); was calved February 12, 1884; bred by himself; *s.* "Lord Currypool" (1589); *d.* "Moss Rose 3rd" (5532), by "Duke of Farrington" (1323); *g. d.* "Bouche's Moss Rose" (4124); *gr. g. d.* "Splendid 1st" (4955).

764 RICHARD BICKLE, Bradstone Hall, Tavistock, Devonshire: THIRD PRIZE, 5*l.*, for "Champion" (1696); was calved July 14, 1883; bred by the late Mr. H. Davy, Penhole House, Launceston, Cornwall; *s.* "Champion" (1522); *d.* "Cowslip 3rd" (6225), by "Agricola 2nd" (1675); *g. d.* "Cowslip," by "Napoleon" (1173); *gr. g. d.* "Primrose," by "Warrior" (548).

767 JOHN HOWSE, Stainborough, Washford, R.S.O., Somersetshire: the *Reserve Number* and *Highly Commended*, for "The Vicar" (2156); was calved January 16, 1886; bred by himself; *s.* "Druid" (1317); *d.* "Lily 6th" (5479), by "Young Profit's Duke"; *g. d.* "Lily 4th" (4684), by "Master Bertie" (1402); *gr. g. d.* "Lily 3rd" (4683), by "Robin Hood" (914); *gr. g. g. d.* "Lily 2nd" (4682).

No. 768 was *Highly Commended.*

No. 765 was *Commended.*

Class 68.—*Devon Bulls, calved in the Year* 1887. [6 entries.]

774 JOHN FARTHING, Currypool, Bridgwater, Somersetshire: FIRST PRIZE, 20*l.*, for "Robin Hood," was calved March 30; bred by himself; *s.* "Master Walter" (1808); *d.* "Robin's Duchess 3rd" (6293), by "Royal Duke" (1640).

773 JOHN HOWSE, Stainborough, Washford: SECOND PRIZE, 10*l*, for "Candy;" was calved April 21; bred by himself; *s.* "Druid" (1317); *d.* "Lily 6th" [*a*] (6446); by "King of the Gipsies" (1580); *g. d.* "Lily 5th" (5478); *gr. g. d.* "Lily 3rd" (4683), by "Robin Hood" (914); *gr. g. g. d.* "Lily 2nd" (4682).

772 RICHARD BICKLE, Bradstone Hall, Tavistock: THIRD PRIZE 5*l.*, for "Actor;" was calved March 24; bred by himself; *s.* "Gladstone" (1737); *d.* "Actress 2nd" (5946) by "Narcissus" (1617); *g. d.* "Actress" (5068), by "Dolly's Duke" (1315); *gr. g. d.* "Nora" (2895), by "Garibaldi 1st" (842); *gr. g. g. d.* "Primrose" (2264).

771 VISCOUNT FALMOUTH, Tregothnan, Probus, Cornwall: the *Reserve Number* and *Highly Commended*, for "Jack in the Green;" was calved April 12; bred by himself; *s.* "Duke of Flitton 17th" (1544); *d.* "Water Lily" (5050), by "Jonquil" (1131); *g. d.* "Watercress" (4006), by "Sunflower" (937); *gr. g. d.* "Cheesewring" (2572*a*), by "Protector" (711); *gr. g. g. d.* "Lilias," by "Duke of Chester" (404).

No. 769 was *Commended.*

Class 69.—*Devon Cows or Heifers, in-milk or in-calf, calved previously to, or in the Year* 1885. [5 entries.]

775 SIR WILLIAM WILLIAMS, Bart., Heanton, Barnstaple, Devonshire: FIRST PRIZE, 15*l.*, for "Fairmaid;" was calved February 16, 1884; in-milk; calved January 15, 1888; bred by himself; *s.* "Duke of Flitton 17th;" *d.* "Gentle."

778 ALFRED C. SKINNER, Pound Farm, Bishop's Lydeard, Somersetshire: SECOND PRIZE, 10*l.*, for "Moss Rose 8th" (7017); was calved February 5, 1881; in-milk; calved February 9, 1888; bred by the late Mr. Walter Farthing, Stowey Court, Bridgwater; *s.* "Lord Stowey" (1601); *d.* "Moss Rose 5th" (4758), by a son of "Forester" (1108); *g. d.* "Moss Rose" (3716), by "Island Prince" (862).

779 JOHN HOWSE, Stainborough, Washford: THIRD PRIZE, 5*l.*, for "Daisy" (5815); was calved December 22, 1881; calved June 2, 1888; bred by Viscount Portman, Bryanston, Blandford, Dorsetshire; *s.* "Shamrock" (1643); *d.* "Damsel" (4380), by "Prince Albert" (907); *g. d.* "Damsel."

Class 70.—*Devon Heifers, calved in the Year* 1886. [8 entries.]

780 SIR WILLIAM WILLIAMS, Bart., Heanton, Barnstaple, Devonshire: FIRST PRIZE, 15*l.*, for "Flower 2nd;" was calved June 2; bred by himself; *s.* "Eclipse" (1728); *d.* "Flower 8th" (4502), by "Young Palmerston" (1251); *g. d.* "Young Flower" (4020), by "Duke of Flitton 4th" (827); *gr. g. d.* "Young Flower" (1357), by "Earl of Exeter" (38); *gr. g. g. d.* "Flower" (189), by "Hundred Guinea" (56).

781 SIR WILLIAM WILLIAMS, Bart., SECOND PRIZE, 10*l.*, for "Georgina 2nd;" was calved October 5; bred by himself; *s.* "Sir Michael;" *d.* "Georgina."

787 RICHARD BICKLE, Bradstone Hall, Tavistock: THIRD PRIZE, 5*l.*, for "Jessie 2nd" (7427); was calved July 21; bred by himself; *s.* "Gladstone" (1737); *d.* "Jessie" (4578), by "Earl of Hexworthy" (1091); *g. d.* "Jenny 2nd" (3583), by "Garibaldi 1st" (842); *gr. g. d.* "Jenny Lind" (2092), by "Monarch" (460); *gr. g. g. d.* "Jenny Lind" (2091).

784 EDWARD J. STANLEY, M.P., Quantock Lodge, Bridgwater, Somersetshire: the *Reserve Number* and *Highly Commended*, for "Princess 2nd;" was calved March 10; bred by himself; *s.* "General Colley" (1564); *d.* "Princess Beatrice" (7114); *g. d.* "Her Majesty" (6317).

No. 782 was *Highly Commended.*

No. 783 was *Commended.*

Class 71.—*Devon Heifers, calved in the Year* 1887. [8 entries.]

789 SIR WILLIAM WILLIAMS, Bart., Heanton: FIRST PRIZE, 15*l.*, for "Foam 3rd;" was calved June 4; bred by himself; *s.* "Foreman" (1968); *d.* "Lady Currypool" (5430), by "Profit's Duke" (1194).

788 SIR WILLIAM WILLIAMS, Bart., SECOND PRIZE, 10*l.*, for "Daisy 4th;" was calved January 8; bred by himself; *s.* "Sir Michael;" *d.* "Daisy 3rd," by "Duke of Flitton 17th."

793 ALFRED C. SKINNER, Pound Farm, Bishop's Lydeard: THIRD PRIZE, 5*l.*, for "Myrtle 28th;" was calved June 23; bred by himself; *s.* "Lord Currypool" (1589); *d.* "Myrtle 6th" (5543), by "Duke of Farrington" (1323); *g. d.* "Myrtle 3rd" (4767), by "Red Prince" (1432); *gr. g. d.* "Myrtle 2nd" (4766); *gr. g. g. d.* "Myrtle 1st" (4765), by "Squire Winter" (1453).

790 WILLIAM H. PUNCHARD, Bourton Hall, Totnes, Devonshire: the *Reserve Number* and *Highly Commended*, for "Gentle 24th;" was calved April 14; bred by Mr. A. C. Skinner, Pound, Bishop's Lydeard; *s.* "Lord Currypool" (1589); *d.* "Gentle 16th" (7009), by "Fancy's Robin" (1556); *g. d.* "Gentle 11th" (5346), by Duke of Farrington" (1323); *gr. g. d.* "Gentle 7th" (4520), by "Sir Wroth" (1451).

No. 792 was *Highly Commended.*

No. 791 was *Commended.*

Sussex.

Class 72.—*Sussex Bulls, calved in either* 1883, 1884, 1885 *or* 1886. [8 entries.]

801 WILLIAM STEWART FORSTER, Gore Court, Maidstone, Kent: FIRST PRIZE, 20*l.*, for "Mikado" (705); was calved January 15, 1884; bred by Mr. A. Holmes, Rye, Sussex; *s.* "Steyning" (729); *d.* "Lily."

799 JOSEPH GODMAN, Park Hatch, Godalming, Surrey: SECOND PRIZE, 10*l.*, for "Nobleman" (707); was calved April 30, 1884; bred by himself; *s.* "Napoleon 3rd" (396); *d.* "Cauliflower" (2199); *g. d.* "Comely" (1482).

800 WILLIAM WOOD, Clayton, Hassocks, Sussex: THIRD PRIZE, 5*l.*, for "Oxford 2nd" (771); was calved December 12, 1884; bred by Mr. Stewart Oxley, Fen Place, Crawley, Sussex; *s.* "Oxford 1st" (513); *d.* "Lady Ham" (2876), by "Lord Bath" (281); *g. d.* "Belle" (1917), by "Croydon" (245); *gr. g. d.* "Beatrice" (1832), by "Bristol" (219); *gr. g. g. d.* "Reeve."

803 SIR FRANCIS MONTEFIORE, Bart., Worth Park, Crawley, Sussex: the *Reserve Number* and *Highly Commended*, for "Gold Dust 9th" (675); was calved February 14, 1885; bred by Mr. A. Stanford, Steyning, Sussex; *s.* "Goldsmith" (391); *d.* "Hardy 3rd" (2237), by "Clayton" (319); *g. d.* "Hardy 1st," by "Dorchester" (235); *gr. g. d.* "Hardy" (2039), by "Young Westminster" (159); *gr. g. g. d.* "Mayflower" (1190).

Class 73.—*Sussex Bulls, calved in the Year* 1887. [13 entries.]

807 J. STEWART HODGSON, Lythe Hill, Haslemere, Surrey: FIRST PRIZE, 20*l.*; was calved May 7; bred by himself; *s.* "King Rufus" (758); *d.* "Laura 3rd" (2055), by "Little Tom;" *g. d.* "Laura 1st" (2053), by "Mottingham" (190); *gr. g. d.* "Young Gentle."

816 THE EARL OF WINTERTON, Shillinglee Park, Petworth, Sussex: SECOND PRIZE, 10*l.*, for "Gold" (815); was calved July 16; bred by Messrs. E. and A. Stanford, of Eatons, Ashurst, Steyning; *s.* "Gold Dust 11th" (677); *d.* "Rosedew 3rd" (2131), by "Bedford" (316); *g. d.* "Rosedew" (2128), by "Young Westminster" (159).

809 THE AYLESBURY DAIRY CO., LIMITED, Horsham, Sussex: THIRD PRIZE, 5*l.*, for "Clancarty;" was calved February 11; bred by Mr. W. S. Forster, Gore Court, Maidstone; *s.* "Mikado" (705); *d.* "Buttercup 2nd" (2791), by "Bedlam" (448); *g. d.* "Buttercup" (2197); *gr. g. d.* "Duchess."

815 WILLIAM S. FORSTER, Gore Court: the *Reserve Number* and *Highly Commended*, for "Nero;" was calved June 27; bred by himself; *s.* "Mikado" (705); *d.* "Splendour" (2145), by "Robinson Crusoe (267); *g. d.* "Jaira."

No. 808 was *Commended.*

Class 74.—*Sussex Cows or Heifers, in-milk or in-calf, calved previously to or in the Year* 1885. [9 entries.]

817 WALTER BLANDFORD WATERLOW, High Trees, Redhill, Surrey: FIRST PRIZE, 15*l.*, for "Elsa" (3214); was calved April 29, 1884; in-milk; calved January 11, 1888; bred by himself; *s.* "Wallace" (478); *d.* "Norma" (2272), by "The Czar" (312); *g. d.* "Nancy" (1871); *gr. g. d.* "Strawberry."

819 J. STEWART HODGSON, Lythe Hill, Haslemere, Surrey: SECOND PRIZE, 10*l.*, for "Laura 7th" (3268); was calved January 6, 1884; in-milk; calved January 7, 1888; bred by himself; *s.* "Lord Oxford" (461); *d.* "Laura 3rd" (2055), by "Little Tom;" *g. d.* "Laura 1st" (2053), by "Mottingham" (190); *gr. g. d.* "Young Gentle."

818 LOUIS HUTH, of Possingworth Manor, Waldron, Sussex: THIRD PRIZE, 5*l.*, for "Lilly 2nd" (2882); was calved April 15, 1880; in-calf [calved September 30, 1888]; bred by himself; *s.* "Sir Roger 1st;" *d.* "Lilly" (2636), by "Reeves;" *g. d.* "Lilly," by "Gower" (70); *gr. g. d.* "Stag Lilly" (379), by "Lilly" (8); *gr. g. g. d.* "Stag Lilly 1st" (94).

824 JOSEPH GODMAN, Park Hatch, Godalming, Surrey: the *Reserve Number* and *Highly Commended*, for "Noble Lady 2nd" (3541); was calved January 27, 1885; in-milk; calved January 10, 1888, bred by himself; *s.* "Goldboy" (541); *d.* "Noble Lady" (2911), by "Napoleon 3rd;" (396); *g. d.* "Noble" (2270); by the "Bainden Bull;" *gr. g. d.* "Noble" (1800), by "Sultan."

Class 75.—*Sussex Heifers, calved in the Year* 1886. [8 entries.]

832 WILLIAM S. FORSTER, Gore Court, Maidstone: FIRST PRIZE, 15*l.*, for "Parade" (4106); was calved April 23; bred by himself; *s.* "Mikado" (705); *d.* "Splendour" (2145), by "Robinson Crusoe" (267); *g. d.* Jaira.

830 JOSEPH GODMAN, Park Hatch, Godalming: SECOND PRIZE, 10*l.*, for "Comely 9th" (3682); was calved January 16; bred by himself; *s.* "Goldboy" (541); *d.* "Cherry" (2558); by "Napoleon 3rd" (396); *g. d.* "Cauliflower" (2199); *gr. g. d.* "Comely" (1482).

831 WILLIAM S. FORSTER, Gore Court: THIRD PRIZE, 5*l.*, for "Acorn" (3867); was calved August 8; bred by himself; *s.* "Stella's Oxford" (651); *d.* "Prebble" (3319), by "Beckley" (241); *g. d.* "Prebble" (1876).

833 BARCLAY FIELD, Bushy Trees, Kemsing, Kent: the *Reserve Number* and *Highly Commended*, for "Young Golding 2nd;" was calved September 23, 1886; bred by himself; *s.* "Young Hereford;" *d.* "Young Golding 1st" (2739), by "Samson" (79).

Class 76.—*Sussex Heifers, calved in the Year* 1887. [16 entries.]

849 BARCLAY FIELD, Busby Trees, Kemsing: FIRST PRIZE, 15*l.*, for "Primrose;" was calved January 21; bred by himself; *s.* "Gold Dust 2nd" (593); *d.* "Hardy 10th" (3048), by "Goldsmith" (391).

838 CHARLES B. GODMAN, Woldringfold, Horsham, Sussex: SECOND PRIZE, 10*l.*, for "Sunset" (4160); was calved January 13; bred by himself; *s.* "Gold Dust 4th" (595); *d.* "Sunshade" (3598); by "Lord Beaconsfield" (459); *g. d.* "Sunflower" (2495), by "President" (305); *gr. g. d.* Sceptic (1726); *gr. g. g. d.* "Primrose."

836 J. STEWART HODGSON, Lythe Hill, Haslemere: THIRD PRIZE, 5*l.*, for "Pride of the Family 7th" (4119); was calved April 5; bred by himself; *s.* "Prince Rufus" (515); *d.* "Pride of the Family 2nd" (2469), by "Young Hartley;" *g. d.* "Pride of the Family," by "Midsummer the Younger;" *gr. g. d.* "Young Broad;" *gr. g. g. d.* "Broad," by "Monarch" (20).

844 WILLIAM WOOD, Clayton, Hassocks, Sussex: the *Reserve Number* and *Highly Commended*, for "Briony 7th" (3921); was calved January 10; bred by himself; *s.* "Oxford 2nd" (771); *d.* "Briony 4th" (3399), by "Golding" (597); *g. d.* "Briony" (2323), by "Knelle" (421).

Nos. 835 and 848 were *Commended.*

Welsh.

Class 77.—*Welsh Bulls, calved in either* 1883, 1884, 1885 *or* 1886. [6 entries.]

851 COLONEL HENRY PLATT, Gorddinog, Llanfairfechan, Carnarvonshire: FIRST PRIZE, 20*l.*, for "Ap Gwilym;" was calved in February, 1883; bred by Mr. William Jones, Taihirion, Gaerwen, Anglesey; *s.* "Gwilym;" *d.* "Blackan;" *g. d.* "Blackan Back," by "Owain Tudor."

852 COLONEL HENRY PLATT: SECOND PRIZE, 10*l.*, for "Prince Frederick;" was calved in September, 1885; bred by Mr. W. E. Oakeley, Plâs, Tan-y-bwlch, Merionethshire; *s.* "Duke of Chester;" *d.* "Lady Mary."

855 THE EARL OF CAWDOR, Stackpole Court, Pembroke: THIRD PRIZE 5*l.*, for "Ulundy;" was calved January 6, 1886; bred by himself; *s.* "Zulu;" *d.* "Peggy Lewis" (82).

850 WILLIAM E. OAKELEY, The Plâs, Tan-y-bwlch, Merionethshire: the *Reserve Number* and *Highly Commended*, for "Harlech" (96); was calved June 3, 1884; bred by Lord Harlech, Glyn, Talsarnan, Merionethshire; *s.* "Zulu" (138); *d.* "Gypsy" (254), by "Black Prince" (4); *g. d.* "Clws," by "Prince Llewellyn 2nd."

Nos. 853 *and* 854 *were Commended.*

Class 78.—*Welsh Bulls, calved in the Year* 1887. [5 entries.]

859 COLONEL HENRY PLATT, Gorddinog: FIRST PRIZE, 20*l.*, for "Cromwell;" was calved April 12; bred by himself; *s.* "Ap Gwilym;" *d.* "Cariaa."

858 COLONEL HENRY PLATT: SECOND PRIZE, 10*l.*, for "Columbus;" was calved in May; bred by himself; *s.* "Ap Gwilym," *d.* "Cynnaes."

157 Alexander Milne Dunlop, Hafod-y-Bryn Farm, Llanbedr, R.S.O., Merionethshire: Third Prize, 5*l.*, for "Nonconformist;" was calved June 17; bred by himself; *s.* "Einion" (92); *d.* "Minnie My" (240), by "Black Prince" (4); *g. d.* "Queen."

Class 79.—*Welsh Cows or Heifers, in-milk or in-calf, calved previously to or in the Year* 1885. [9 entries.]

865 Colonel Henry Platt, Gorddinog: First Prize, 15*l.*; was calved in July, 1885; in-calf; bred by himself; *s.* "Baronet 1st," *d.* "Selby."

866 Colonel Henry Platt: Second Prize, 10*l.*, for "Mona's Pride;" was calved in March, 1883; in-milk; calved May 11, 1888; breeder unknown.

861 William E. Oakeley, The Plâs, Tan-y-Bwlch: Third Prize, 5*l.*, for "Regalia" (307); was calved in January, 1879; in-milk; calved January 5, 1888; bred by Mr. R. Richards, Victoria Hotel, Llanbedr, Merionethshire.

864 Colonel Henry Platt: the *Reserve Number* and *Highly Commended*; was calved in January, 1885; in-calf; bred by himself; *s.* "Baronet 1st;" *d.* "Black Queen."

Nos. 862, 867, 868, and 869 were *Commended.*

Class 80.—*Welsh Heifers, calved in the Year* 1886. [4 entries.]

873 The Earl of Cawdor, Stackpole Court, Pembroke: First Prize, 15*l.*, for "Rosal 7th;" was calved April 7; bred by himself; *s.* "Young King" (137); *d.* "Rosal 2nd" (249).

872 Colonel Henry Platt, Gorddinog: Second Prize, 10*l.*, for "Princess Tonet;" was calved April 14; bred by himself; *s.* "Baronet 1st;" *d.* "Princess of Wales."

870 William E. Oakeley, The Plâs, Tan-y-Bwlch, Merionethshire: Third Prize, 5*l.*, for "Betty;" was calved January 17; bred by himself; *s.* "Duke of Chester" (20); *d.* "Netty" (306).

Class 81.—*Welsh Heifers, calved in the Year* 1887. [6 entries.]

877 Colonel Henry Platt, Gorddinog: First Prize, 15*l.*; was calved in March; bred by himself; *s.* "Ap Gwilym;" *d.* "Black Queen 3rd."

874 William E. Oakeley, The Plâs, Tan-y-Bwlch: Second Prize, 10*l.*, for "Heather Bell;" was calved February 17; bred by himself; *s.* "Harlech" (96); *d.* "Hatty" (304); *g. d.* "Netty" (306).

875 Lord Harlech, Glyn, Talsarnan, R.S.O., Merionethshire: was calved January 21; bred by himself; *s.* "Einion;" *d.* "Vesta."

876 Colonel Henry Platt, Gorddinog: the *Reserve Number* and *Highly Commended*; was calved March 11; bred by himself; *s.* "Ap Gwilym;" *d.* "Black Queen 2nd."

No. 879 was *Commended.*

Red Polled.

Class 82.—*Red Polled Bulls, calved in either* 1883, 1884, 1885, *or* 1886. [6 entries.]

882 William Amhurst Tyssen-Amherst, M.P., Didlington Hall, Brandon, Norfolk: First Prize, 20*l.*, for "Didlington Davyson 2nd" (657); was calved January 7, 1883; bred by himself; *s.* "Davyson 12th"

(481); *d.* "Davy 24th" (1448), by "Davyson 5th" (287); *g. d.* "Davy 15th" (844), by "Davyson 3rd" (48); *gr. g. d.* "Davy 5th" (167), by "Tenant Farmer" (213); *gr. g. g. d.* "Davy" (163).

880 ALFRED TAYLOR, Starston Place, Harleston, Norfolk: SECOND PRIZE, 10*l.*, for "Bardolph" (977); was calved January 23, 1886; bred by Mr. J. J. Colman, M.P., Norwich; *s.* "Falstaff" (303); *d.* "Silent Woman" (2537), by "Rufus" (188); *g. d.* "Silent Lass" (1189), by "Powell" (143); *gr. g. d.* "Silence" (548), by "Rifleman" (175); *gr. g. g. d.* "Silence" (O 9).

883 JEREMIAH JAMES COLMAN, M.P., Carrow House, Norwich: THIRD PRIZE, 5*l.*, for "Iago" (1025); was calved January 20, 1885; bred by exhibitor; *s.* "Othello" (713); *d.* "Silent Lady" (1855), by "Rufus" (188); *g. d.* "Silent Lass" (1189), by "Powell" (143); *gr. g. d.* "Silence," by "Rifleman" (175); *gr. g. g. d.* "Silence" (O 9).

885 LORD HASTINGS, Melton Constable, East Dereham, Norfolk: the *Reserve Number* and *Highly Commended*, for "The Duke" (334); was calved April 12, 1884; bred by himself; *s.* "Roscoe" (559); *d.* "Davy Duchess 3rd" (2145), by "Davyson 7th" (476); *g. d.* "Davy 16th" (845), by "Red Jacket 7th" (169); *gr. g. d.* "Davy 7th" (160), by "Young Duke" (234); *gr. g. g. d.* "Davy 2nd," by "Sir Nicholas" (202).

No. 881 was *Highly Commended.*

No. 884 was *Commended.*

Class 83.—*Red Polled Bulls, calved in the Year* 1887. [6 entries.]

891 LORD HASTINGS, Melton Constable: FIRST PRIZE, 20*l.*, for "Viceroy;" was calved February 18; bred by himself; *s.* "Roscoe" (559); *d.* "Rupee" (2520), by "Priam" (373); *g. d.* "Rosamond" (1136), by "Norfolk Duke" (127); *gr. g. d.* "Rosebud" (489), by "Stoke Duke" (209); *gr. g. g. d.* "Rose of Eaton" (504), by "Cringleford Sire" (44).

888 WILLIAM AMHURST TYSSEN-AMHERST, M.P., Didlington Hall, Brandon: SECOND PRIZE, 10*l.*, for "Monarch;" was calved March 8; bred by himself; *s.* "Morella" (895); *d.* "Emblem" (2782), by "Davyson 3rd" (48); *g. d.* "Eleanor" (1477), by "Brutus" (269); *gr. g. d.* "Elmer," by "Elmham Sire" (67).

886 ALFRED TAYLOR, Starston Place, Harleston: THIRD PRIZE, 5*l.*, for "Nimrod;" was calved June 20; bred by himself; *s.* "Passion" (714); *d.* "Sunbeam" (3164), by "Kelpie" (685); *g. d.* "Sly" (1192), by "Sir Edward 1st" (197); *gr. g. d.* "Strawberry" (575), by "Richard 2nd" (173); *gr. g. g. d.* "Tiny" (604), by "Laxfield Sire" (101).

889 WILLIAM AMHURST TYSSEN-AMHERST, M.P., Didlington Hall: the *Reserve Number* and *Highly Commended*, for "Murgatroyd;" was calved March 30; bred by himself; *s.* "Morella" (895); *d.* "Norfolk Witch" (1054), by "Norfolk Duke" (127); *g. d.* "Witch" (657), by "Tommy" (216); *gr. g. d.* "Clara" (111).

No. 890 was *Commended.*

Class 84.—*Red Polled Cows or Heifers, in-milk or in-calf, calved previously to or in the year* 1885. [7 entries.]

897 JEREMIAH JAMES COLMAN, M.P., Carrow House, Norwich: FIRST PRIZE, 15*l.*, for "Midsummer Rose" (2976); was calved June 26, 1884;

in-milk; calved January 10, 1888; bred by himself; *s.* "Othello" (713); *d.* "Rosebud" (1797), by "Rufus" (188); *g. d.* "Rosebud" (494), by "Norfolk Duke" (127); *gr. g. d.* "Cherry" (K 17), by "Tenant Farmer" (213).

896 William Amhurst Tyssen-Amherst, M.P., Didlington Hall, Brandon: Second Prize, 10*l.*, for "Emblem" (2782): was calved February 4, 1884; in-milk: calved February 6, 1888: and in-calf: bred by himself; *s.* "Davyson 3rd" (48); *d.* "Eleanor" (1477), by "Brutus" (269); *g. d.* "Elmer" (1483), by "Elmham Sire" (67).

894 John Hammond, Bale, Dereham, Norfolk: Third Prize, 5*l.*, for "Davy 44th;" was calved August 16, 1882; in-milk; calved February 13, 1888; bred by himself; *s.* "Davyson 7th;" *d.* "Davy 27th" (1451), by "Davyson 5th; *g. d.* "Davy 5th," by "Tenant Farmer."

895 John Hammond, Bale: the *Reserve Number* and *Highly Commended*, for "Davy 64th;" was calved January 30, 1885; in-calf; bred by himself; *s.* "Roland;" *d.* "Davy 37th," by "Davyson 7th;" *g. d.* "Davy 21st," by "Davyson 5th."

No. 898 was *Highly Commended.*

Nos. 892 and 893 were *Commended.*

Class 85.—*Red Polled Heifers, calved in the Year* 1886. [6 entries.]

903 Jeremiah James Colman, M.P., Carrow House, Norwich: First Prize, 15*l.*, for "Midget;" was calved February 4; bred by himself; *s.* "Ben" (795); *d.* "Rosebud" (1797), by "Rufus" (188); *g. d.* "Rosebud" (494), by "Norfolk Duke" (127); *gr. g. d.* "Cherry" (K 17), by "Tenant Farmer" (213).

899 Alfred Taylor, Starston Place, Harleston: Second Prize, 10*l.*, for "Coercion" (3945); was calved November 23; bred by himself; *s.* "Kimberley" (867); *d.* "Cosy" (2719), by "Passion" (714); *g. d* "Cossett 2nd" (2103), by "King Charles" (329); *gr. g. d.* "Cossett" (1405), by "Rifleman" (175); *gr. g. g. d.* "Cowslip" (O 3).

904 Lord Hastings, Melton Constable, East Dereham, Norfolk: Third Prize, 5*l.*, for "Gladys" (4066): was calved May 12; in-calf; bred by himself; *s.* "Rupert" (746); *d.* "Nectarine 2nd" (2405), by "Davyson 7th" (476); *g. d.* "Dainty" (819), by "Prince Charlie" (151); *gr. g. d.* "Nancy" (359), by "Framshom Captain" (71); *gr. g. g. d.* "Tit" (6).

900 John Hammond, Bale, Dereham: the *Reserve Number* and *Highly Commended*, for "Davy 73rd;" was calved January 6; bred by himself; *s.* "Davyson 18th;" *d.* "Davy 48th," by "Davy Butler;" *g. d.* "Davy 34th."

No. 901 was *Commended.*

Class 86.—*Red Polled Heifers, calved in the Year* 1887. [8 entries.]

909 Jeremiah James Colman, M.P., Carrow House, Norwich: First Prize, 15*l.*, for "Mar;" was calved January 5; bred by himself; *s.* "Othello" (713); *d.* "Marham" (2356), by "Priam" (373); *g. d.* "Hester" (267), by "The Peer" (139); *gr. g. d.* "Rose 5th" (M 2), by "Tenant Farmer" (213); *gr. g. g. d.* "Red Rose" (M 2).

910 Jeremiah James Colman, M.P., Carrow House: Second Prize, 10*l.*, for "Buttercup;" was calved February 13; bred by himself; *s.*

"Falstaff" (303); *d.* "Brunette" (2044), by "King Charles" (329); *g. d.* "Brown" (1343), by "Duke of Norfolk" (295); *gr. g. d.* "Isabelle" (P 3), by "Norfolk Duke" (127).

907 WILLIAM AMHURST TYSSEN-AMHERST, M.P., Didlington Hall, Brandon: THIRD PRIZE, 5*l.*, for "Poppety 2nd;" was calved February 22; bred by himself; *s.* "Didlington Davyson 2nd" (657); *d.* "Poppinette" (2455), by "Davyson 3rd" (48); *g. d.* "Poppy" (2456), by "Stout" (581); *gr. g. d.* "Poppet 2nd" (1087), by "Cherry Duke" (32); *gr. g. g. d.* "Poppet" (1086), by "Sampson" (191).

905 THOMAS TINDAL METHOLD, Hepworth, Diss, Suffolk: the *Reserve Number* and *Highly Commended*, for "Hepworth Davy 2nd;" was calved January 16; bred by himself; *s.* "Cortes" (645); *d.* "Davy 41st" (2133), by "Davyson 7th" (476); *g. d.* "Davy 5th" (167), by "Tenant Farmer" (213); *gr. g. d.* "Davy."

Nos. 908 and 911 were *Highly Commended.*

Jersey.

Class 87.—*Jersey Bulls, calved in either* 1883, 1884, 1885 *or* 1886. [29 entries.]

921 MRS. HOPWOOD, Ketton Hall, Stamford: FIRST PRIZE, 20*l.*, for "Chestnut Boy," silver grey; was calved October 11, 1884; imported; breeder unknown; *s.* "Nero du Coin" (1849 E.H.B.); *d.* "Neva;" *g. d.* "Daisy;" *gr. g. d.* "Young Daisy," by "Orange Peel" (608); *gr. g. g. d.* "Daisy."

930 THE EARL OF LONDESBOROUGH, Northerwood, Lyndhurst, Hampshire: SECOND PRIZE, 10*l.*, for "Marius," dark grey; was calved February 18, 1886; bred by himself; *s.* "Rainbow" (1943 E.H.B.); *d.* "Maria 3rd;" *g. d.* "Maria" (1662 J.H.B.).

935 JAMES RICHARD CORBETT, More Place, Betchworth, Surrey: THIRD PRIZE, 5*l.*, for "Franciscan," dark grey; was calved September 2, 1886; bred by Mr. J. S. Arthur, of St. Mary's, Jersey; *s.* "Royal Khedive" (628 J.H.B.); *d.* "Golden Crown" (6524), by "Tusquantum" (262).

933 WILLIAM EDWARD BUDGETT, Stoke Bishop, Bristol: the *Reserve Number* and *Highly Commended*, for "Frivol," dark fawn; was calved July 15, 1886; bred by himself; *s.* "Royal Blue;" *d.* "Fair Maid," by "Rover" (1978); *g. d.* "Patti," by "Sambo" (748); *gr. g. d.* "Pretty," by "Host" (423); *gr. g. g. d.* "Sultana."

Nos. 924, 927, 929, 931, and 940 were *Highly Commended.*

Nos. 914, 919, and 932 were *Commended.*

Class 88.—*Jersey Bulls, calved in the Year* 1887. [28 entries.]

965 WILLIAM ARKWRIGHT, Sutton Scarsdale, Chesterfield, Derbyshire: FIRST PRIZE, 20*l.*, for "Hamilton" (1043 J.H.B.), dark grey; was calved February 25; bred by Mr. J. C. Hamon, St. John's, Jersey; *s.* "Carlo 3rd;" *d.* "Gloire d'Or" (5628); *g. d.* "Procès" (4045), by "Carlo" (180); *gr. g. d.* "Pry" (103), by "Paukee" (27); *gr. g. g. d.* "Clyde" (446).

942 GEORGE SIMPSON, Wray Park, Reigate, Surrey: SECOND PRIZE, 10*l.*, for "Bessie's Boy," grey fawn; was calved April 22; bred by himself; *s.* "Wolseley's Glory" (2168 E.H.B.); *d.* "Bessie," by "Noble 2nd" (1172 E.H.B.); *g. d.* "Beauty" (637 J.H.B.).

948 SALISBURY BAXENDALE, Bonningtons, Ware, Herts: THIRD PRIZE, 5*l.*, for "Hamley," whole colour; was calved August 17; bred by himself; *s.* "Wolseley's Glory 2nd" (2169); *d.* "Briar," by "Young Neptune" (1847); *g. d.* "Blackberry," by "Bacchus" (984); *gr. g. d.* "Briony."

967 WILLIAM DAVID TUCKER, 74, High Street, Southampton: the *Reserve Number* and *Highly Commended*, for "Grouville's Champion," dark grey; was calved March 14; bred by Mr. W. G. Aubyn, Manfant, St. Saviour's, Jersey; *s.* "Everton King" (390); *d.* "Manfant Princess" (6004).

Nos. 945, 946, and 968 were *Highly Commended.*

Nos. 943, 952, 955, 960, and 963 were *Commended.*

Class 89.—*Jersey Cows, in-milk or in-calf, calved previously to, or in the Year* 1884. [23 entries.]

987 WILLIAM E. BUDGETT, Stoke Bishop, Bristol: FIRST PRIZE, 15*l.*, for "Black Bess" (3749 J.H.B.); dark brown; was calved in 1880; in-milk; calved January 15, 1888; bred by Mr. J. Arthur, La Pompe, St. Mary's, Jersey.

970 GEORGE SIMPSON, Wray Park, Reigate: SECOND PRIZE, 10*l.*, for "Bessie," grey fawn; was calved May 12, 1879; in-milk; calved March 19, 1888; bred by Mr. P. Mourant, St. Saviour's, Jersey; *s.* "Noble 2nd" (1172 E.H.B.); *d.* "Beauty."

971 GEORGE SIMPSON, Wray Park: THIRD PRIZE, 5*l.*, for "Rosy 3rd" (1540 J.H.B.), yellow fawn; was calved January 26, 1884; in-milk; calved April 8, 1888; bred by Mr. W. Alexander, jun., Les Marais, St. Mary's, Jersey; *s.* "Wolseley" (2165 E.H.B.); *d.* "Rosy" (512 J.H.B.), by "Carlo" (180 J. H. B.); *g. d.* "Catherine" (1366).

983 THE EARL OF LONDESBOROUGH, Northerwood: the *Reserve Number* and *Highly Commended*, for "Les Prairies Flandrine," brown; was calved March 29, 1883; in-milk; calved May 3, 1888; bred by Mr. P. W. Picot, Beech Farm, St. John's, Jersey; *s.* "Golden Cloud" (1632 E.H.B.); *d.* "Zinnia" (4519 J.H.B.), by "Neptune" (586 E.H.B.)

Nos. 972 and 982 were *Highly Commended.*

Nos. 976, 977, 978, and 990 were *Commended.*

Class 90.—*Jersey Cows or Heifers, in-milk or in-calf; calved in the Year* 1885. [16 entries.]

996 JOHN EDMUND GROOM, Great Walsingham: FIRST PRIZE, 15*l.*, for "Buttermaker's Daughter," dark fawn; was calved September 23; in-milk; calved in June, 1887; bred by Mr. Robinson, St. Peter's, Jersey; *s.* "Buttermaker's Boy" (432 J.H.B.); *d.* "Joyful" (3720 J.H.B.).

1002 HUGH C. SMITH, Mount Clare, Roehampton, Surrey: SECOND PRIZE, 10*l.*, for "Beauty," fawn; was calved March 19; in-milk; calved April 20, 1888; bred by the late Dr. Meadows, Poyle Manor, Colnbrook, Buckinghamshire; *s.* "Messenger" (1816); *d.* "Lily Grey," by "Mignon" (1157); *g. d.* "La Perchade."

1000 THE EARL OF LONDESBOROUGH, Northerwood: THIRD PRIZE, 5*l.*, for "Governess," dark fawn; was calved January 2; calved May 26, 1888; bred by himself; *s.* "Rainbow" (1943 E.H.B.); *d.* "Dame Suzeraine."

994 SIR HUMPHREY F. DE TRAFFORD, Bart., Trafford Park, Manchester: the *Reserve Number* and *Highly Commended*, for "Rozels Fuschia," grey fawn; was calved May 27; in-calf; bred by Mr. J. Germain, Ville Maux, Rozel, Jersey; *s.* "Brave" (392 J.H.B.); *d.* "Western" (4098 J.H.B.).

Nos. 1003, 1005, and 1007 were *Highly Commended.*

Nos. 999 and 1008 were *Commended.*

Class 91.—*Jersey Heifers, calved in the Year* 1886. [41 entries.]

1036 EDWARD PARSONS FOWLER, Southampton: FIRST PRIZE, 15*l.*, for "Golden Lass 4th," brown; was calved March 16; in-calf; bred by J. P. Marett, Jersey; *s.* "Sultan's Cicero" (670 J.H.B.); *d.* "Golden Lass" (5711 J.H.B.).

1009 GEORGE SIMPSON, Wray Park, Reigate: SECOND PRIZE, 10*l.*, for "Pandora 10th," grey fawn; was calved April 2; in-milk; calved March 22, 1888; bred by himself; *s.* "Valentine" (2126); *d.* "Pandora 4th," by "Duke of Cyprus" (288); *g. d.* "Pandora 2nd," by "Milord" (566); *gr. g. d.* "Pandora" (1645 J.H.B.).

1026 HENRY JAMES CORNISH, Thornford, Sherborne, Dorsetshire: THIRD PRIZE, 5*l.*, for "Madeira 3rd," grey; was calved February 18; in-milk: calved April 25, 1888; bred by Mr. E. Renouf, St. Brelade's, Jersey; *s.* "Wolseley" (2165 E.H.B.); *d.* "Madeira" (2090 J.H.B.).

1034 EDWARD PARSONS FOWLER, Southampton: the *Reserve Number* and *Highly Commended*, for "Cicero's Sultan," fawn; was calved April 25; in-calf; bred by Mr. J. P. Marett, Jersey; *s.* "Sultan's Cicero" (670 J.H.B.); *d.* "Sultana 7th" (771 J.H.B.).

Nos. 1013, 1015, 1017, 1022, 1028, 1037, 1039, 1041, 1044, 1045, and 1046 were *Highly Commended.*

Nos. 1010 and 1032 were *Commended.*

Class 92.—*Jersey Heifers, calved in the Year* 1887. [44 entries.]

1070 HENRY JAMES CORNISH, Thornford, Sherborne: FIRST PRIZE, 15*l.*, for "Fair Angela," fawn; was calved June 12; bred by Mr. F. Le Brocq, St. Peter's, Jersey; *s.* "Highland Lad" (845 J.H.B.); *d.* "Miss Angela" (2040 J.H.B.)

1050 GEORGE SIMPSON, Wray Park, Reigate: THIRD PRIZE, 10*l.*, for "Lady Godiva," yellow fawn; was calved July 9; bred by himself; *s.* Zerebat (1886 E.H.B.); *d.* "Lady Georgina," by "Nero du Coin" (1849 E.H.B); *g. d.* "Ferrieres' Pride" (6727 J.H.B.).

1065 GEORGE WILLIAM PALMER, Elmhurst, Reading, Berkshire: THIRD PRIZE, 5*l.*, for "Fancy's Pride," fawn; was calved April 27; bred by himself; *s.* "Baron Elmhurst 4th;" *d.* "Wolseley's Fancy," by "Wolseley" (2165); *g. d.* "Bobby's Last" (6641).

1093A MRS. PERKINS, of Oakdene, Holmwood, Surrey: the *Reserve Number* and *Highly Commended*, for "Lady Prim," light fawn; was calved January 18; bred by herself; *s.* "Lord of Carolina;" *d.* "Longueville Pride," by "Cossack;" *g. d.* "Duchess Galopin."

Nos. 1052, 1053, 1071, 1072, and 1091 were *Highly Commended.*

Nos. 1057, 1073, 1076, 1080, 1083, 1088, and 1090 were *Commended.*

Guernsey.

Class 93.—*Guernsey Bulls, calved in either* 1883, 1884, 1885, *or* 1886. [12 entries.]

1098 HUGH STANLEY MORRIS, Pear Tree House, Bitterne, Southampton: FIRST PRIZE, 20*l.*, for "Norman" (198 E.G.H.B.), red and white; was calved August 7, 1886; bred by Mr. F. Carey, The Cottage, Castel, Guernsey; *s.* "Volage;" *d.* "Trophy."

1097 WILLIAM ANTHONY GLYNN, Seagrove, Seaview, Isle of Wight: SECOND PRIZE, 10*l.*, for "Hopeful" (25 E.G.H.B), orange fawn and white; was calved May 17, 1884; bred by himself.

1103 SIR FRANCIS MONTEFIORE, Bart., Worth Park, Crawley, Sussex: THIRD PRIZE, 5*l.*, for "Sir Francis" (155), fawn and white; was calved in December, 1884; bred by Mr. Robins, Castel, Guernsey; *s.* "Climax" (48); *d.* "Fair Lass" (562); *g. d.* "Mignonette" (229), by "Fleurie;" *gr. g. d.* "Type 2nd" (153), by "Champion" (37); *gr. g. g. d.* "Type 1st."

1096 GEORGE LONG, Ogbourne St. Andrew, Marlborough, Wilts: the *Reserve Number* and *Highly Commended*, for "Original" (451), pale red and white; was calved October 18, 1886; bred by Mr. G. Williams, Guernsey; *s.* "Master Dick" (233); *d.* "Gold Drop of Mount Arrisé."

Class 94.—*Guernsey Bulls, calved in the Year* 1887. [9 entries.]

1112 HUGH STANLEY MORRIS, Pear Tree House, Bitterne: FIRST PRIZE, 20*l.*, for "Constantine," fawn and white; was calved May 15; bred by Major Green, St. Martin's, Guernsey; *s.* "Master Tom" (170); *d.* "Constance 2nd" (166).

1110 WILLIAM ANTHONY GLYNN, Seagrove: SECOND PRIZE, 10*l.*, for "Surprise," orange fawn and white; was calved July 26; bred by himself; *d.* "Havant."

1111 HUGH STANLEY MORRIS, Pear Tree House, Bitterne: THIRD PRIZE, 5*l.*, for "Humphry," fawn and white; was calved May 15; bred by Major Green, St. Martin's, Guernsey; *s.* "Master Tom" (170); *d.* "Constance 2nd" (166).

1108 GEORGE LONG, Ogbourne St. Andrew: the *Reserve Number* and *Highly Commended*, for "Goldfield," lemon fawn and white; was calved December 6; bred by himself; *s.* "Cloth of Gold 17th" (87 E.G.H.B.); *d.* "Lady Moore" (600 E.G.H.B.), by "Mahomet;" *g. d.* "Polly."

No. 1109 was *Highly Commended.*

No. 1113 was *Commended.*

Class 95.—*Guernsey Cows or Heifers, in-milk or in-calf, calved previously to or in the Year* 1885. [12 entries.]

1119 HUGH STANLEY MORRIS, Pear Tree House, Bitterne: FIRST PRIZE, 15*l.*, for "Blossom" (21 E.G.H.B.), fawn and white; was calved June 24, 1880; in-milk; calved March 10, 1888; bred by Mr. W. A. Glynn, Seagrove, Seaview, Isle of Wight.

1117 WILLIAM ANTHONY GLYNN, Seagrove: SECOND PRIZE, 10*l.*, for "La Belle" (15 E.G.H.B.), orange, white and fawn; was calved June 4, 1884; in-milk; calved June 8, 1888; bred by himself; *s.*

"Billy 4th" (7 E.G.H.B.); *d.* "Lovely 2nd" (217 E.G.H.B.), by "Billy 3rd;" *g. d.* "Lovely 1st," by "Johnny 1st;" *gr. g. d.* "Beauty."

1115 GEORGE LONG, Ogbourne St. Andrew, Marlborough: THIRD PRIZE, 5*l.*, for "Rheta" (666 E.G.H.B.), lemon fawn and white; was calved June 30, 1884; in-milk; calved December 10, 1887; and in-calf; bred by Mr. E. Cohn, Landes du Marché, Vale, Guernsey; *s.* "Emigrant" (173); *d.* "Rosette 2nd" (655), by "Royal George" (120); *g. d.* "Rosette" (529).

1125 WILLIAM DAVID TUCKER, 74, High Street, Southampton: the *Reserve Number* and *Highly Commended*, for "Butter of Gold 3rd," red and white; was calved April 20, 1884; in-calf; bred by Mr. F. Le Messurier, St. Martin's, Guernsey; *s.* "Barman" (186); *d.* "Butter of Gold" (9431).

Nos. 1116 and 1126 were *Highly Commended.*

No. 1120 was *Commended.*

Class 96.—*Guernsey Heifers, calved in the Year* 1886. [12 entries.]

1129 WILLIAM ANTHONY GLYNN, Seagrove: FIRST PRIZE, 15*l.*, for "Favourite 7th" (7593 E.G.H.B.), orange fawn and white; was calved July 22; in-calf; bred by himself; *s.* "Champion" (11 E.G.H.B.); *d.* "Favourite 4th" (111 E.G.H.B.), by "Billy 4th" (7 E.G.H.B.); *g. d.* "Favourite 2nd" (110 E.G.H.B.).

1131 HUGH STANLEY MORRIS, Pear Tree House, Bitterne, Southampton: SECOND PRIZE, 10*l.*, for "Frederica 4th" (558 E.G.H.B.), fawn and white; was calved April 22; in-milk; calved April 18, 1888; bred by himself; *s.* "Welcome" (198); *d.* "Frederica 3rd" (557 E.G.H.B.) by "Sarago" (32); *g. d.* "Lady Frederica;" *gr. g. d.* "Favorita of Saints."

1128 GEORGE LONG, Ogbourne St. Andrew, Marlborough: THIRD PRIZE, 5*l.*, for "Fan 4th" (544 E.G.H.B.), lemon fawn and white; was calved August 9; in-milk; calved May 9, 1888; bred by himself; *s.* "Minstrel" (234); *d.* "Fan 3rd" (543 E.G.H.B.), by "Farmer's Pride" (157); *g. d.* "Fan 2nd" (105) by "Trial" (94); *gr. g. d.* "Fan" (46), by "Baron" (90); *gr. g. g. d.* "Rose."

1132 THE EXPRESS DAIRY COMPANY, LIMITED, College Farm, Finchley, Middlesex: the *Reserve Number* and *Highly Commended*, for "Constantia" (1926), orange fawn and white; was calved January 31; in-milk; calved May 5, 1888; bred by Mr. T. Le Patourel, Ville Amphrey, St. Martin's, Guernsey; *s.* "Ajax" (208); *d.* "Black Watch" (1319).

No. 1130 was *Highly Commended.*

Nos. 1133 and 1136 were *Commended.*

Class 97.—*Guernsey Heifers, calved in the Year* 1887. [20 entries.]

1140 GEORGE LONG, Ogbourne St. Andrew: FIRST PRIZE, 15*l.*, for "Nora 3rd," fawn and white; was calved March 25; bred by himself; *s.* "Cloth of Gold 17th" (87 E.G.H.B.); *d.* "Nora 2nd" (165), by "Dr. Bill" (161); *g. d.* "Nora" (493), by "St. Andrews 2nd" (2).

1141 GEORGE LONG, Ogbourne St. Andrew: SECOND PRIZE, 10*l.*, for "Colonia 1st;" lemon fawn and white; was calved March 11;

bred by himself; *s.* "Cloth of Gold 17th" (87 E.G.H.B.); *d.* "Colonia" (338 E.G.H.B.) by "Turk" (165); *g. d.* "Polly 2nd of Marais" (400).

1151 THE EXPRESS DAIRY COMPANY, LIMITED, Finchley: THIRD PRIZE, 5*l.*, for "Polly 4th," fawn and white; was calved May 28; bred by themselves; *s.* "Squire of the King's Mills" (302); *d.* "Polly 3rd," by "Luther" (199).

1156 SIR FRANCIS MONTEFIORE, Bart., Worth Park, Crawley, Sussex: the *Reserve Number* and *Highly Commended*, for "Laura 3rd," fawn and white; was calved August 20; bred by himself; *s.* "Valentine;" *d.* "Laura 2nd" (1986), by "Royalist."

No. 1146 was *Highly Commended.*

No. 1157 was *Commended.*

Dairy Cattle.

Class 98.—*Two Dairy Cows of the Shorthorn Type, in-milk.** [10 entries.]

1159 WILLIAM HOLLINS, Jun., Pleasley Vale, Mansfield, Nottinghamshire: FIRST PRIZE, 20*l.*, for "Daisy," roan; was calved in February, 1883; calved March 26, 1888; bred by Mr. B. P. Gregson, Caton, Lancashire; and for "Sabrina," roan; was calved July 31, 1882; in-calf; bred by the late Mr. Joseph Gibson; *s.* "Fortune Teller" (44836); *d.* "Scylla," by "Captain Gwynne" (37940).

1161 JOSEPH HARRIS, Calthwaite Hall, Carlisle, Cumberland: SECOND PRIZE, 10*l.*, for "Indian Girl," roan; was calved April 8, 1882; calved April 10, 1888; bred by himself; *s.* "Wild Strawberry" (44264); *d.* "Indian Maid," by "Wild Indian" (32867); and for "Lady Mary," roan; was calved in 1882; calved March 6, 1888; bred by Mr. M. Savage, Keld, Westmoreland; *s.* "Earl of Doune" (36579).

1164 GEORGE THOMPSON, Mousley End House, Wroxall, Warwickshire: the *Reserve Number* and *Highly Commended*, for "Clarissa," roan; was calved February 7, 1882; calved March 1, 1888; bred by Mr. Kendal, Droitwich; *s.* "Albion;" *d.* "Cecilia 3rd," by "Javellar;" *g. d.* "Cecilia 1st," by "St. Patrick;" *gr. g. d.* "Cecilia," by "St. John;" and for "Miss Plumper," roan; was calved March 1, 1881; calved March 1, 1888; bred by himself; *s.* "Ada's Prince."

Nos. 1160 and 1163 were *Commended.*

Class 99.—*Two Dairy Heifers, under three years old, in-milk, of any breed or cross.** [3 entries.]

1169 JOSEPH HARRIS, Calthwaite Hall, Carlisle, Cumberland: FIRST PRIZE, 15*l.*, for "Oxford Duchess of Calthwaite 4th" (Shorthorn); was calved October 1, 1885; *s.* "Duke of Holker 7th" (49456); *d.* "Turncroft Duchess of Oxford," by "Grand Duke 39th" (43308); *g. d.* "Oxford Duchess of Killhow," by "Oxford Duke of Killhow" (42091); and for "Eva Gwynne" (Shorthorn); was calved July 13, 1885; *s.* "Model Butterfly" (53323); *d.* "Polly Gwynne," by "The Colonel" (35747); *g. d.* "Nannie Gwynne," by "British Knight" (33230). Both bred by himself.

1170 JOHN JERVIS SHARP, Broughton, Kettering, Northamptonshire: SECOND PRIZE, 10*l.*, for "Statira 33rd" (Shorthorn), roan; was

calved November 26, 1885; calved February 23, 1888; *s.* "Connaught Lad" (47619); *d.* "Statira 31st," by "Viceroy" (47198); *g. d.* "Statira 29th," by "Duke of Darlington 4th" (38138); and for "Phylia's Bud" (Shorthorn); was calved January 28, 1886; calved May 31, 1888; *s.* "Connaught Lad" (47619); *d.* "Phylia," by "Baron Shendish 5th" (44374); *g. d.* "Prize Flower," by "Duke of Darlington 4th" (38138).

1171 LORD EGERTON of TATTON, Tatton Park, Knutsford, Cheshire: the *Reserve Number* and *Highly Commended,* for "Her Highness," red and white; was calved in November, 1885; and his "Roan;" was calved in March, 1886. Both bred by himself.

Class 100.[1]—*Dairy Cow in-milk of any breed or cross, over* 1,200 *lbs. live weight, and giving not less than* 40*lbs.* (*about* 4 *imperial gallons*) *of milk daily.** [9 entries.]

1177 WILLIAM ARKWRIGHT, Sutton Scarsdale, Chesterfield, Derbyshire: a PRIZE of 15*l.*, for "Scarsdale Beauty" (cross-bred), roan; was calved in 1881; calved May 9, 1888; breeder unknown.

1178 GEORGE SAMPSON, Beauchief Abbey, Sheffield: a PRIZE of 15*l.*, for "Daisy" (Shorthorn), roan; calved June 11, 1888; age and breeder unknown.

Class 101.[1]—*Dairy Cow in-milk of any breed or cross, under* 1,200 *lbs. live weight, and giving not less than* 25 *lbs.* (*about* $2\frac{1}{2}$ *imperial gallons*) *of milk daily.* [12 entries.]

1192 WILLIAM DAVIES, Bollington, Altrincham, Cheshire: FIRST PRIZE, 20*l.*, for "Daisy" (Jersey), silver grey and white; was calved in 1884; calved May 22, 1888; breeder unknown.

1183 EDWARD CARTER, Puckpool House, Ryde, Isle of Wight: SECOND PRIZE, 10*l.*, for "Frieda" (Jersey), fawn; was calved April 28, 1880; calved March 2, 1888; bred by Messrs. J. and M. Arnold, of Court Farm, West Meon, Hampshire; *s.* "Five Hides" (326); *d.* "Nan 3rd," by "Young Prince" (683).

SHEEP.

Leicester.

Class 102.—*Two-Shear Rams.* [11 entries.]

1200 ROBERT HARRISON, Underpark, Lealholm, Grosmont, Yorkshire: FIRST PRIZE, 15*l.*; was dropped in March, 1886; bred by the late Mr. T. Stamper, Highfield House, Oswaldkirk.

1193 TEASDALE H. HUTCHINSON, Manor House, Catterick, Yorkshire: SECOND PRIZE, 10*l.*; was dropped March 17, 1886; bred by himself.

1194 TEASDALE H. HUTCHINSON: THIRD PRIZE, 5*l.*; was dropped in March, 1886; bred by himself.

1202 TOM D. STRICKLAND, the Stud Farm, Thirsk Junction, Yorkshire: the *Reserve Number* and *Highly Commended*; was dropped in March, 1886; bred by Mr. J. B. Green, Silsden, Yorkshire.

No. 1195 was *Highly Commended.*

No. 1199 was *Commended.*

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[1] The prizes for Classes 100 and 101 were awarded on the certificate of the Steward of Cattle.

Class 103.—*Shearling Rams.* [14 entries.]

1205 JOHN and DAVID LINTON, Low Street Brewery, Bedale, Yorkshire: FIRST PRIZE, 15*l.*; was dropped April 12, 1887; bred by themselves.

1213 ROBERT HARRISON, Underpark, Lealholm, Grosmont: SECOND PRIZE, 10*l.*; was dropped in March, 1887; bred by himself.

1214 ROBERT HARRISON: THIRD PRIZE, 5*l.*; was dropped in March, 1887; bred by himself.

1217 WILLIAM WALSH, Gilstead, Bingley, Yorkshire: the *Reserve Number* and *Commended*; was dropped March 7, 1887; bred by Mr. J. B. Green, Low House Farm, Silsden.

Class 104.—*Ram Lambs, dropped in the Year* 1888.—*Pens of Three.* [6 entries.]

1222 WILLIAM WALSH, Gilstead: FIRST PRIZE, 10*l.*; were dropped March 2; bred by Mr. J. B. Green, Low House Farm, Silsden.

1220 ROBERT HARRISON, Underpark, Lealholm, Grosmont: SECOND PRIZE, 5*l.*; were dropped in March; bred by himself.

1221 WILLIAM WALSH, Gilstead, Bingley: the *Reserve Number* and *Commended*; were dropped March 2; bred by Mr. J. B. Green, Low House Farm, Silsden.

Class 105.—*Shearling Ewes.*—*Pens of Five.* [6 entries.]

1228 ERNEST FRANCIS JORDAN, Eastburn, Driffield, Yorkshire: FIRST PRIZE, 15*l.*; were dropped in April, 1887; bred by himself.

1229 ERNEST FRANCIS JORDAN: SECOND PRIZE, 10*l.*; were dropped in April, 1887; bred by himself.

1225 MRS. PERRY HERRICK, Beau Manor Park, Loughborough, Leicestershire: the *Reserve Number* and *Highly Commended*; were dropped about April 1, 1887; bred by herself.

Border Leicester.

Class 106.—*Rams, Two-Shear and upwards.* [10 entries.]

1234 SAMUEL JACK, Crichton Mains, Pathhead, Dalkeith, Midlothian: FIRST PRIZE, 15*l.*; was dropped in May, 1885; bred by himself.

1231 THE RIGHT HON. ARTHUR J. BALFOUR, M.P., Whittinghame, Prestonkirk, N.B.: SECOND PRIZE, 10*l.*; was dropped in March, 1886; bred by himself.

1236 ALEXANDER R. MELVIN, Bonnington, Wilkieston, Midlothian: THIRD PRIZE, 5*l.*; was dropped in March, 1884; bred by Messrs. Clark, Oldhamstocks Mains, Cockburnspath, Haddingtonshire.

1233 THOMAS WINTER, High Coniscliffe, Darlington, Co. Durham: the *Reserve Number* and *Highly Commended*; was dropped in March, 1886; bred by the Right Hon. A. J. Balfour, M.P., Whittinghame, Prestonkirk.

The whole Class was *Commended.*

Class 107.—*Shearling Rams.* [20 entries.]

1241 THE RIGHT HON. ARTHUR J. BALFOUR, M.P., Whittinghame: FIRST PRIZE, 15*l.*; was dropped in March, 1887; bred by himself.

1255 Alexander R. Melvin, Bonnington, Wilkieston, Midlothian: Second Prize, 10*l.*; was dropped in March, 1887; bred by himself.

1240 The Right Hon. Arthur J. Balfour, M.P., of Whittinghame: Third Prize, 5*l.*; was dropped in March, 1887; bred by himself.

1249 Samuel Jack, Crichton Mains, Pathhead, Dalkeith, N.B.: was dropped about February, 1887; bred by himself.

Class 108.—*Ewes, Two-Shear and upwards. Pens of Five.* [7 entries.]

1260 The Right Hon. Arthur J. Balfour, M.P., Whittinghame, Prestonkirk: First Prize, 15*l.*; ages various; bred by himself.

1265 Alexander R. Melvin, of Bonnington, Wilkieston, Midlothian, N.B.: Second Prize, 10*l.*; ages various; bred by himself.

1261 George Simson, Courthill, Kelso, Roxburgh, N.B.: Third Prize, 5*l.*; were dropped in March, 1884; bred by himself.

1266 Samuel P. Foster, Killhow, Mealsgate, Carlisle, Cumberland: the *Reserve Number* and *Highly Commended*; ages various; bred by himself.

Class 109.—*Shearling Ewes.—Pens of Five.* [6 entries.]

1267 The Right Hon. Arthur J. Balfour, M.P., Whittinghame, Prestonkirk: First Prize, 15*l.*; were dropped in March, 1887; bred by himself.

1272 Alexander R. Melvin, Bonnington: Second Prize, 10*l.*; were dropped in March, 1887; bred by himself.

1268 George Simson, Courthill, Kelso, Roxburgh, N.B.: Third Prize, 5*l.*; were dropped in March, 1887; bred by himself.

1269 Thomas Winter, High Coniscliffe, Darlington, Co. Durham: the *Reserve Number* and *Highly Commended*; were dropped in March, 1887; bred by himself.

The whole Class was *Highly Commended.*

Cotswold.

Class 110.—*Two-Shear Rams.* [4 entries.]

1275 George Bagnall, Westwell Manor, Burford, Oxon.: First Prize, 15*l.*; was dropped in February, 1886; bred by himself.

1276 George Bagnall: Second Prize, 10*l.*; was dropped in January, 1886; bred by himself.

1273 Russell Swanwick, Royal Agricultural College Farm, Cirencester, Gloucestershire: the *Reserve Number* and *Highly Commended*; was dropped February 10, 1886; bred by himself.

Class 111.—*Shearling Rams.* [6 entries.]

1277 Russell Swanwick, Royal Agricultural College Farm, Cirencester: First Prize, 15*l.*; was dropped February 7, 1887; bred by himself.

1280 Russell Swanwick: Second Prize, 10*l.*; was dropped February 7, 1887; bred by himself.

1278 Russell Swanwick: the *Reserve Number* and *Highly Commended*; was dropped February 7, 1887; bred by himself.

No. 1279 was *Commended.*

Class 112.—*Ram Lambs, dropped in the Year* 1888. *Pens of Three.* [3 entries.]

1284 Robert Jacobs, Signet Hill, Burford, Oxfordshire: First Prize, 10*l.*; were dropped in January; bred by himself.

1285 Robert Jacobs: Second Prize, 5*l.*; were dropped about January 24; bred by himself.

1283 Russell Swanwick, Royal Agricultural College Farm, Cirencester: the *Reserve Number* and *Commended*; were dropped February 14; bred by himself.

Class 113.—*Shearling Ewes.—Pens of Five.* [2 entries.]

1286 Joseph Maddocks, Llanwarne Court, Hereford: First Prize, 15*l.*; were dropped in March, 1887; bred by himself.

1287 George Bagnall, Westwell Manor, Burford: Second Prize, 10*l.*; were dropped in January, 1887; bred by himself.

Lincoln.

Class 114.[1]—*Two-Shear Rams.* [14 entries.]

1294 Robert Wright, Nocton Heath, Lincoln: First Prize, 25*l.*; was dropped in February or March, 1886; bred by Mr. Charles Clarke, Scopwick, Lincoln.

1300 John Pears, Mere, Lincoln: Second Prize, 15*l.*; was dropped in February, 1886; bred by himself.

1295 Robert Wright, Nocton Heath: Third Prize, 5*l.*; was dropped in February, or March, 1886; bred by himself.

1290 Henry Dudding, Riby Grange, Great Grimsby, Lincolnshire: the *Reserve Number* and *Highly Commended*; was dropped about March 14, 1886; bred by Mr. H. Mackinder, Langton, Spilsby, Lincolnshire.

Class 115.—*Shearling Rams.* [47 entries.]

1310 Henry Dudding, Riby Grange: First Prize, 30*l.*; was dropped about March 14, 1887; bred by himself.

1316 Robert Wright, Nocton Heath: Second Prize, 20*l.*; was dropped in February or March, 1887; bred by himself.

1317 Robert Wright: Third Prize, 15*l.*; was dropped in February or March, 1887; bred by himself.

1340 John Pears, Mere, Lincoln: Fourth Prize, 10*l.*; was dropped in February, 1887; bred by himself.

1306 Henry Dudding, Riby Grange: Fifth Prize, 5*l.*; was dropped about March 14, 1887; bred by himself.

1319 Robert Wright, Nocton Heath: the *Reserve Number* and *Highly Commended*; was dropped in February or March, 1887; bred by himself.

Nos. 1320 and 1347 were *Highly Commended.*

Nos. 1302, 1334, 1339, 1341, and 1346 were *Commended.*

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[1] Towards the Prizes for Lincoln Sheep 95*l.* was contributed to the funds of the Local Committee by the Lincolnshire Agricultural Society.

Class 116.—*Ram Lambs, dropped in the Year* 1888.—*Pens of Three.* [12 entries.]

1358 John Pears, Mere, Lincoln: First Prize, 15*l.*; were dropped in February; bred by himself.

1359 John Pears: Second Prize, 10*l.*; were dropped in February; bred by himself.

1356 William Roe, North Scarle Field, Newark: the *Reserve Number* and *Commended*; were dropped in February; bred by himself.

The whole Class was *Commended.*

Class 117.—*Shearling Ewes.*—*Pens of Five.* [10 entries.]

1361 Henry Dudding, Riby Grange: First Prize, 25*l.*; were dropped about March 14, 1887; bred by himself.

1363 Robert Wright, Nocton Heath: Second Prize, 15*l.*; were dropped in February or March, 1887; bred by himself.

1365 William Hesseltine, Beaumont Cote, Barton-on-Humber, Lincolnshire: Third Prize, 5*l.*; were dropped in March, 1887; bred by himself.

1369 James Cartwright, Dunston Pillar, Dunston, Lincolnshire: the *Reserve Number* and *Commended*; were dropped about February 20, 1887; bred by W. and J. Cartwright, Dunston Pillar.

Other Long-Woolled.

Class 118.—*Two-Shear Rams.* [2 entries.]

1371 Sir John Heathcoat Heathcoat Amory, Bart., Knightshayes Court, Tiverton, Devonshire: First Prize, 10*l.*, for his Devon long-wool; was dropped February 21, 1886; bred by himself.

1372 Sir John Heathcoat Heathcoat Amory, Bart.: the *Reserve Number* and *Highly Commended,* for his Devon long-wool; was dropped February 14, 1886; bred by himself.

Class 119.—*Shearling Rams.* [5 entries.]

1376 Alfred C. Skinner, Pound Farm, Bishop's Lydeard, Somerset: First Prize, 10*l.*, for his Devon long-wool; was dropped about February 1, 1887; bred by himself.

1374 Sir John Heathcoat Heathcoat Amory, Bart., Knightshayes Court: Second Prize, 5*l.*, for his Devon long-wool; was dropped February 28, 1887; bred by himself.

1375 John and David Linton, Low Street Brewery, Bedale, Yorkshire: the *Reserve Number* and *Highly Commended,* for their Devon long-wool; was dropped April 17, 1887; bred by themselves.

Class 120.—*Shearling Ewes.*—*Pens of Five.* [1 entry.]

1378 Sir John Heathcoat Heathcoat Amory, Bart., Knightshayes Court: First Prize, 10*l.*, for his Devon long-wools; were dropped in February and March, 1887; bred by himself.

Oxfordshire Down.

Class 121.—*Two-Shear Rams.* [3 entries.]

1381 Charles Hobbs, Maisey Hampton, Fairford, Gloucestershire: First Prize, 15*l.*; was dropped about February 15, 1886; bred by himself.

1380 George Street, Maulden, Ampthill, Bedfordshire: Second Prize, 10*l.*; was dropped in February, 1886; bred by himself; *s.* "Treadwell's No. 25;" *d.* by "Treadwell's No. 2."

Class 122.—*Shearling Rams.* [29 entries.]

1401 George Adams, Pidnell, Faringdon, Berkshire: First Prize, 15*l.*, for "The Duke;" was dropped in January, 1887; bred by himself; *s.* "Mr. Druce's No. 5;" *d.* by "Young Swell."

1394 John Treadwell, Upper Winchendon, Aylesbury, Bucks: Second Prize, 10*l.*, for "No. 117;" was dropped about February 22, 1887; bred by himself; *s.* "Case's No. 10;" *d.* by "Baron Oxford."

1390 John Treadwell: Third Prize, 5*l.*, for "No. 74;" was dropped about February 15, 1887; bred by himself; *s.* "Brassey No. 22;" *d.* by "Duke of Oxford."

1391 John Treadwell: the *Reserve Number* and *Highly Commended*, for "No. 55;" was dropped about February 15, 1887; bred by himself; *s.* "Young Freeland;" *d.* by "Young Comet."

Nos. 1382, 1388, 1392, 1395, 1398, 1399, and 1409 were *Highly Commended.*

The whole Class was *Commended.*

Class 123.—*Ram Lambs, dropped in the Year* 1888.—*Pens of Three.* [6 entries.]

1413 Robert W. Hobbs, Kelmscott, Lechlade, Gloucestershire: First Prize, 10*l.*; were dropped about January 25; bred by himself.

1412 A. F. Milton Druce, of Fyfield, Abingdon, Berks: Second Prize, 5*l.*; were dropped about February 7; bred by himself.

1415 George Adams, Pidnell, Faringdon: the *Reserve Number* and *Highly Commended*; were dropped in January; bred by himself; *s.* "Mr. Druce's No. 5."

Class 124.—*Shearling Ewes.—Pens of Five.* [6 entries.]

1421 George Adams, Pidnell: First Prize, 15*l.*; were dropped in January, 1887; bred by himself; *s.* "Mr. Druce's No. 5;" *d.* by "Young Swell."

1417 George Street, Maulden, Ampthill, Bedfordshire: Second Prize, 10*l.*; were dropped in February, 1887; bred by himself; *ss.* "C. Howard's No. 1" and "Treadwell's No. 25;" *dd.* by "Treadwell's No. 2" and "No. 28."

1422 The Countess of Camperdown, Weston House, Shipston-on-Stour, Warwickshire: the *Reserve Number* and *Highly Commended*; were dropped in February, 1887; bred by herself.

Nos. 1418, 1419, and 1420 were *Commended.*

Shropshire.

Class 125.—*Two-Shear Rams.* [24 entries.]

1436 JOSEPH BEACH, The Hattons, Wolverhampton, Staffordshire: FIRST PRIZE, 15*l.*, for "Royal Jubilee;" was dropped in March, 1886; bred by himself; *s.* "Royal Chief" (1022); *d.* by "Minton's Pride" (858).

1433 JOHN HARDING, Norton House, Shifnal, Salop: SECOND PRIZE, 10*l.*, for "Lord Cardigan;" was dropped March 4, 1886; bred by himself.

1423 FRANCIS BACH, Onibury, Craven Arms, Salop: THIRD PRIZE, 5*l.*;* was dropped March 19, 1886; bred by himself; *s.* "Baron Coxcombe" (1846); *d.* by "Double R" (172).

1431 ARTHUR S. GIBSON, Springhill, Bulwell, Nottinghamshire: FOURTH PRIZE, 2*l.*,* for "Bulwell Prince;" was dropped in March, 1886; bred by himself.

1446 MRS. BARRS, Odstone Hall, Atherstone: the *Reserve Number* and *Highly Commended*; was dropped in March, 1886; bred by herself.

No. 1427 was *Highly Commended.*

Nos. 1434 and 1438 were *Commended.*

Class 126.—*Shearling Rams.* [99 entries.]

1468 A. E. MANSELL, Broughton, Harmer Hill, Shrewsbury: FIRST PRIZE, 15*l.*; was dropped in March, 1887; bred by himself.

1521 THE EXECUTORS OF THE LATE SIR ROBERT LODER, Bart., Whittlebury, Towcester, Northamptonshire: SECOND PRIZE, 10*l.*; was dropped March 1, 1887; bred by the late Sir Robert Loder, Bart.; *s.* "The Dean" (2356); *d.* by "Chesham 2nd" (362).

1480 MRS. BARRS, Odstone Hall: THIRD PRIZE, 5*l.*;* was dropped in March, 1887; bred by herself.

1514 JOSEPH BEACH, The Hattons, Wolverhampton: FOURTH PRIZE, 2*l.*;* was dropped March 2, 1887; bred by himself.

1479 MRS. BARRS, Odstone Hall: the *Reserve Number* and *Highly Commended*; was dropped in March, 1887; bred by herself.

Nos. 1448, 1462, 1472, 1481, 1483, 1485, 1491, 1506, 1515, 1522, and 1528 were *Highly Commended.*

Nos. 1449, 1455, 1461, 1463, 1465, 1471, 1478, 1489, 1490, 1492, 1517, 1525, 1527, 1529, and 1536 were *Commended.*

Class 127.—*Ram Lambs, dropped in the Year* 1888. *Pens of* [22 entries.]

1551 THOMAS and SAMUEL BRADBURNE, Ashwood Hill, Redditch, Worcestershire: FIRST PRIZE, 10*l.*; were dropped in March; bred by themselves; *s.* "Iron Chief."

1560 THE EXECUTORS OF THE LATE SIR ROBERT LODER, Bart., Whittlebury, Towcester: SECOND PRIZE, 5*l.*; were dropped March 15; bred by the late Sir Robert Loder, Bart.; *ss.* "The Baronet" and "Aberdeen" (2449); *dd.* by "Dudmaston Hero" (165), "Chesham 2nd" (362), and "Earl of Leicester" (171).

1554 RICHARD BROWN, Ruyton of the Eleven Towns, Salop; THIRD PRIZE, 3*l.*;* were dropped in March; bred by himself; *s.* "Preston Grand Chief" (3175); *d.* by "Prince Victor" (158).

1550 THOMAS and SAMUEL BRADBURNE, of Ashwood Hill, Redditch: FOURTH PRIZE, 2*l.*;* were dropped in March, 1888: bred by themselves; *s.* "Iron Chief."

1558 RICHARD THOMAS, The Buildings, Baschurch, Salop: the *Reserve Number* and *Highly Commended*; were dropped in March, 1888; bred by himself.

No. 1546 was *Highly Commended.*

Class 128.—*Shearling Ewes.—Pens of Five.* [26 entries.]

1589 PHILIP ALBERT MUNTZ, M.P., Dunsmore, Rugby, Warwickshire: FIRST PRIZE, 15*l.*; were dropped in February and March, 1887; bred by exhibitor; *ss.* "The Candidate" (2838), and "Dunsmore 1st" (2009).

1586 THOMAS S. MINTON, Montford, Salop: SECOND PRIZE, 10*l.*; were dropped in February or March, 1887; bred by himself.

1574 WILLIAM F. INGE, Thorpe Hall, Tamworth, Staffordshire: THIRD PRIZE, 5*l.*;* were dropped in March, 1887; bred by himself; *s.* "Sir Arthur Thorpe" (2814).

1592 JOSEPH PULLEY, Lower Eaton, Hereford: FOURTH PRIZE, 2*l.*;* were dropped March 1, 1887; bred by himself; *ss.* "Touchstone" (1775), and "Young Blue Blood" (2877); *dd.* by "Touchstone" (1775), "Eaton Sultan" (1455), and "Young Colossus" (1301).

1593 R. M. KNOWLES, Colston Bassett Hall, Bingham, Nottinghamshire: the *Reserve Number* and *Highly Commended*; were dropped in March, 1887; bred by himself.

Nos. 1573 and 1577 were *Highly Commended.*

Nos. 1570, 1584 and 1590 were *Commended.*

Southdown.

Class 129.—*Two-Shear Rams.* [18 entries.]

1610 EDWIN ELLIS, Shalford, Guildford, Surrey: FIRST PRIZE, 15*l.*; was dropped about February 14, 1886; bred by himself.

1607 JEREMIAH J. COLMAN, M.P., Carrow House, Norwich; SECOND PRIZE, 10*l.*; was dropped March 1, 1886; bred by himself.

1594 H.R.H. THE PRINCE OF WALES, K.G., Sandringham, Norfolk: THIRD PRIZE, 5*l.*; was dropped in March, 1886; bred by His Royal Highness.

1595 H.R.H. THE PRINCE OF WALES, K.G.: the *Reserve Number* and *Highly Commended*; was dropped in March, 1886; bred by His Royal Highness.

Nos. 1604 and 1609 were *Highly Commended.*

Nos. 1597, 1600, 1602, and 1611 were *Commended.*

Class 130.—*Shearling Rams.* [27 entries.]

1634 JEREMIAH J. COLMAN, M.P., Carrow House, Norwich; FIRST PRIZE, 15*l.*; was dropped March 1, 1887; bred by himself.

1635 JEREMIAH J. COLMAN, M.P.: SECOND PRIZE, 10*l.*; was dropped March 1, 1887; bred by himself.

1613 H.R.H. THE PRINCE OF WALES, K.G., Sandringham: THIRD PRIZE, 5*l.*; was dropped in March, 1887; bred by His Royal Highness.

1619 THE DUKE OF RICHMOND AND GORDON, K.G., Goodwood, Chichester, Sussex: the *Reserve Number* and *Highly Commended*; was dropped in February, 1887; bred by himself.

Nos. 1615, 1632, and 1636 were *Highly Commended.*

Nos. 1618, 1620, 1627, and 1629 were *Commended.*

Class 131.—*Ram Lambs, dropped in the Year* 1888. *Pens of Three.* [14 entries.]

1640 ALFRED HEASMAN, Court Wick, Littlehampton, Sussex: FIRST PRIZE, 10*l.*; were dropped February 15; bred by himself.

1647 THE PAGHAM HARBOUR Co., Selsey, Chichester, Sussex: SECOND PRIZE, 5*l.*; were dropped in February; bred by themselves.

1650 JEREMIAH J. COLMAN, M.P., Carrow House, Norwich: the *Reserve Number* and *Highly Commended*; were dropped about March 1, 1888; bred by himself.

No. 1651 was *Highly Commended.*

Class 132.—*Shearling Ewes. Pens of Five.* [9 entries.]

1654 THE DUKE OF RICHMOND AND GORDON, K.G., Goodwood, Chichester, Sussex: FIRST PRIZE, 15*l.*; were dropped in February, 1887; bred by himself.

1659 JEREMIAH J. COLMAN, M.P., Carrow House: SECOND PRIZE, 10*l.*; were dropped about March 1, 1887; bred by himself.

1660 EDWIN ELLIS, Shalford, Guildford: THIRD PRIZE, 5*l.*; were dropped about February 14, 1887; bred by himself.

1661 THE DUKE OF HAMILTON AND BRANDON, K.T., Easton Park, Wickham Market, Suffolk: the *Reserve Number* and *Highly Commended*; were dropped in March, 1887; bred by himself.

No. 1657 was *Highly Commended.*

The whole Class was *Commended.*

Hampshire Down.

Class 133.—*Two-Shear Rams.* [8 entries.]

1665 HENRY LAMBERT, Babraham, Cambridge: FIRST PRIZE, 15*l.*; was dropped about January 14, 1886; bred by himself.

1667 C. and T. COLES, Manor House, Winterbourne Stoke, Salisbury, Wiltshire: SECOND PRIZE, 10*l.*; was dropped February 7, 1886; bred by themselves.

1662 FRANK R. MOORE, Littlecott, Upavon, Marlborough, Wiltshire: THIRD PRIZE, 5*l.*; was dropped in January, 1886; bred by himself.

1669 THE COLLEGE OF AGRICULTURE, Downton, Hampshire: the *Reserve Number* and *Highly Commended*; was dropped January 20, 1886; bred by themselves.

Class 134.—*Shearling Rams.* [11 entries.]

1672 Henry Lambert, Babraham, Cambridge: First Prize, 15*l.*; was dropped about January 14, 1887; bred by himself.

1671 Frank R. Moore, Littlecott, Upavon, Marlborough: Second Prize, 10*l.*; was dropped in January, 1887; bred by himself.

1679 Robert Coles, The Grange, Warminster, Wiltshire: Third Prize, 5*l.*, for "Young Victor;" was dropped about January 20, 1887; bred by himself.

1677 C. and T. Coles, Manor House, Winterbourne Stoke, Salisbury: the *Reserve Number* and *Highly Commended*; was dropped February 1, 1887; bred by themselves.

No. 1673 was *Commended.*

Class 135.—*Ram Lambs, dropped in the Year* 1888.—*Pens of Three.* [6 entries.]

1685 John Barton, Hackwood Farm, Basingstoke, Hampshire: First Prize, 10*l.*; were dropped in January, 1888; bred by himself.

1682 Henry Lambert, Babraham, Cambridge: Second Prize, 5*l.*; were dropped about January 20; bred by himself.

1683 Robert Coles, The Grange, Warminster: the *Reserve Number* and *Highly Commended*; were dropped about January 20; bred by himself.

No. 1681 was *Commended.*

Class 136.—*Shearling Ewes.—Pens of Five.* [4 entries.]

1688 Henry Perry Keene, Rowfant, Crawley, Sussex: First Prize, 15*l.*; were dropped in January, 1887; bred by himself.

1689 C. and T. Coles, of Manor House, Winterbourne Stoke, Salisbury: Second Prize, 10*l.*; were dropped about February 7, 1887; bred by themselves.

1687 Frank R. Moore, Littlecott, Upavon, Marlborough: the *Reserve Number* and *Highly Commended*; were dropped in January, 1887; bred by himself.

Suffolk.

Class 137.—*Two-Shear Rams.* [5 entries.]

1695 The Marquis of Bristol, Ickworth Park, Bury St. Edmunds, Suffolk: First Prize, 15*l.*, for "Van Gwynne 1st;" was dropped January 15, 1886; bred by himself.

1691 Joseph Smith, Thorpe Hall, Hasketon, Woodbridge, Suffolk: Second Prize, 10*l.*, for "Bismarck;" was dropped in February, 1886; bred by himself.

1692 Joseph Smith: the *Reserve Number* and *Highly Commended*, for "Norwich;" was dropped in February, 1886; bred by himself.

Class 138.—*Shearling Rams.* [7 entries.]

1702 The Marquis of Bristol, Ickworth Park: First Prize, 15*l.*, for "Van Tromp 5th;" was dropped January 20, 1887; bred by himself; *s.* "Van Tromp 3rd" (292).

1696 JOSEPH SMITH, Thorpe Hall, Hasketon: SECOND PRIZE, 10*l.*; was dropped in February, 1887; bred by himself.

1697 JOSEPH SMITH: the *Reserve Number* and *Highly Commended*; was dropped in February, 1887; bred by himself.

Class 139.—*Ram Lambs, dropped in the Year* 1888.—*Pens of Three.* [4 entries.]

1706 THE MARQUIS OF BRISTOL, Ickworth Park: FIRST PRIZE, 10*l.*; were dropped in January; bred by himself; *ss.* "Van Tromp 3rd," "Van Dyke 1st," and "Van Gwynne 3rd."

1703 JOSEPH SMITH, Thorpe Hall, Hasketon: SECOND PRIZE, 5*l.*; were dropped in February; bred by himself.

1705 THE EARL OF ELLESMERE, Stetchworth Park, Newmarket: the *Reserve Number* and *Highly Commended*; were dropped after January 21; bred by himself.

Class 140.—*Shearling Ewes.—Pens of Five.* [2 entries.]

1708 THE MARQUIS OF BRISTOL, Ickworth Park: FIRST PRIZE, 15*l.*; were dropped in January, 1887; bred by himself; *ss.* "Van Tromp 2nd," "Van Tromp 3rd," and "Van Dyke."

1707 JOSEPH SMITH, Thorpe Hall, Hasketon: the *Reserve Number* and *Commended*; were dropped in February, 1887; bred by himself.

Other Short Woolled.

Class 141.—*Two-Shear Rams.* [6 entries.]

1711 JOHN ROBSON, Newton, Bellingham, Northumberland: FIRST PRIZE, 10*l.*, for his Cheviot Ram; was dropped in April, 1886; bred by himself.

1712 JOHN ROBSON: SECOND PRIZE, 5*l.*, for his Cheviot Ram; was dropped in April, 1886; bred by himself.

1713 WILLIAM WALSH, Gilstead, Bingley, Yorkshire: the *Reserve Number*, for his Lonk Ram; was dropped April 10, 1886; bred by Mr. P. Barker, Silsden, Yorkshire.

Class 142.—*Shearling Rams.* [9 entries.]

1719 JOHN ROBSON, Newton, Bellingham: FIRST PRIZE, 10*l.*, for his Cheviot Ram; was dropped in April, 1887; bred by himself.

1720 JOHN ROBSON: SECOND PRIZE, 5*l.*, for his Cheviot Ram; was dropped in April, 1887; bred by himself.

1718 FRANK SHEPHERD, Colwall, Malvern: the *Reserve Number* for his Ryeland Ram; was dropped about March 20, 1887; bred by himself.

No. 1722 was *Highly Commended.*

No. 1715 was *Commended.*

Class 143.—*Shearling Ewes.—Pens of Five.* [6 entries.]

1725 JOHN ROBSON, Newton, Bellingham: FIRST PRIZE, 10*l.*, for his Cheviot Ewes; were dropped in April, 1887; bred by himself.

1728 William Walsh, Gilstead, Bingley: Second Prize, 5*l.*; were dropped in March, 1887; bred by himself and others.

1724 William T. Culverwell, Durleigh Farm, Bridgwater, Somersetshire: the *Reserve Number*, for his Dorset Horn Ewes; were dropped December 25, 1886; bred by himself.

LINCOLNSHIRE LONG WOOL.[1]

Class 144.—*He-Hog—Three Fleeces.* [4 entries.]

1730 George Marris, Holton, Caistor, Lincolnshire: First Prize, 5*l.*

1733 Sir John H. Thorold, Bart., Syston Park, Grantham, Lincolnshire: Second Prize, 2*l.*

1732 Henry Dudding, Riby Grange, Great Grimsby: the *Reserve Number* and *Highly Commended.*

Class 145.—*She-Hog—Three Fleeces.* [5 entries.]

1734 George Marris, Holton, Caistor: First Prize, 5*l.*

1737 Sir John H. Thorold, Bart., Syston Park, Grantham: Second Prize, 2*l.*

1735 Henry Dudding, Riby Grange, Great Grimsby: the *Reserve Number.*

PIGS.

Large White Breed.

Class 146.—*Boars farrowed in the Year* 1887. [8 entries.]

1742 The Earl of Ellesmere, Worsley Hall, Manchester: First Prize, 10*l.*; was farrowed January 2; bred by himself; *s.* "Worsley General" (563); *d.* "Lancashire Lass" (742).

1741 The Earl of Ellesmere: Second Prize, 5*l.*; was farrowed January 2; bred by himself; *s.* "Worsley General" (563); *d.* "Lancashire Lass" (742).

1746 Tom D. Strickland, Stud Farm, Thirsk Junction, Yorkshire: Third Prize, 3*l.*, for "Thirsk Champion 12th;" was farrowed October 21; bred by himself.

1743 The Earl of Ellesmere: the *Reserve Number* and *Highly Commended*; was farrowed January 2; bred by himself; *s.* "Worsley General" (563); *d.* "Lancashire Lass" (742).

Class 147.—*Boar Pigs, farrowed in the Year* 1888.—*Pens of Three.* [4 entries.]

1748 The Earl of Ellesmere, Worsley Hall, Manchester: First Prize, 10*l.*; were farrowed January 2; bred by himself; *s.* "Lancashire Lad;" *d.* "Cleopatra 8th" (348).

[1] Prizes subscribed to the funds of the Local Committee by the Lincolnshire Agricultural Society.

1749 The Earl of Ellesmere: Second Prize, 5*l.*; were farrowed January 3; bred by himself; *s.* "Worsley Giant 2nd;" *d.* "Lancashire Lass 7th."

1747 James Howard, Clapham Park, Bedford; the *Reserve Number* and *Highly Commended*; were farrowed January 15; bred by himself; *s.* "Duke 2nd;" *d.* "Strickland," by "Champion 3rd."

Class 148.—*Breeding Sows, farrowed previously to or in the Year* 1887. [10 entries.]

1753 The Hon. Mrs. Meynell Ingram, Temple Newsam, Leeds: First Prize, 10*l.*, for "Lady Shrewsbury;" was farrowed March 20, 1884; bred by Mr. Beal, Great Kelk, Hull.

1756 William Ramsden, Westfield House, Knotty Ash, Liverpool: Second Prize, 5*l.*, for "Sarah;" was farrowed May 2, 1885; in-pig; breeder unknown.

1751 James Howard, Clapham Park: Third Prize, 3*l.*; was farrowed in July, 1885; in-pig [has since farrowed]; bred by the late Mr. Barnett, Stratton Park, Biggleswade.

1758 Tom D. Strickland, Stud Farm, Thirsk Junction, Yorkshire: the *Reserve Number* and *Highly Commended*; was farrowed March 10, 1886; bred by himself.

No. 1759 was *Highly Commended.*

Class 149.—*Breeding Sow Pigs, farrowed in the Year* 1888. *Pens of Three.* [10 entries.]

1762 The Earl of Ellesmere, Worsley Hall, Manchester: First Prize, 10*l.*; were farrowed January 2; bred by himself; *s.* "Lancashire Lad;" *d.* "Cleopatra 8th" (348).

1763 The Earl of Ellesmere: Second Prize, 5*l.*; were farrowed January 2; bred by himself; *s.* "Worsley General 6th;" *d.* "Lancashire Witch 7th."

1761 James Howard, Clapham Park, Bedford: Third Prize, 3*l.*; were farrowed January 15; bred by himself; *s.* "Duke 2nd;" *d.* "Strickland," by "Champion 3rd."

1765 Thomas Collinson, Shay Farm, Halifax, Yorkshire: the *Reserve Number* and *Highly Commended*, for "Bessie," "Ella," and "Maggie;" were farrowed January 2; bred by himself; *s.* "Ding Dong" (313); *d.* "Lady Ramsden."

No. 1764 was *Commended.*

Middle White Breed.

Class 150.—*Boars farrowed in the Year* 1887. [6 entries.]

1773 The Earl of Ellesmere, Worsley Hall: First Prize, 10*l.*; was farrowed January 3; bred by himself; *s.* "King William" (593); *d.* "Worsley Princess 2nd" (936).

1772 The Earl of Ellesmere: Second Prize, 5*l.*; was farrowed January 3rd; bred by himself; *s.* "King William" (593); *d.* "Worsley Princess 2nd" (936).

1776 WILLIAM RAMSDEN, Westfield House, Knotty Ash, Liverpool: the *Reserve Number* and *Highly Commended*, for "Joe;" was farrowed June 10; bred by himself.

No. 1775 was *Highly Commended.*

Class 151.—*Boar Pigs, farrowed in the Year* 1888.—*Pens of Three.* [2 entries.]

1777 WILLIAM RAMSDEN, Westfield House, Knotty Ash: FIRST PRIZE, 10*l.*; were farrowed January 4; bred by himself.

Class 152.—*Breeding Sows, farrowed previously to or in the Year* 1887. [11 entries.]

1789 F. A. WALKER-JONES, Little Mollington, Chester: FIRST PRIZE, 10*l.*, for "Lilly;" was farrowed January 27, 1886; bred by Mr. P. Ascroft, Rufford, Ormskirk; *s.* "Luck;" *d.* "Gyp" (212), by "Old Bill."

1783 THE HON. MRS. MEYNELL INGRAM, Temple Newsam, Leeds: SECOND PRIZE, 5*l.*, for "Her Majesty;" was farrowed August 20, 1885; bred by herself.

1782 JAMES HOWARD, Clapham Park, Bedford: THIRD PRIZE, 3*l.*; was farrowed June 25, 1886; in-pig [farrowed August 20, 1888]; bred by himself; *s.* "Britannia Wonder;" *d.* "Spot."

1784 THOMAS COLLINSON, Shay Farm, Halifax: the *Reserve Number*, for "Moss Rose;" was farrowed May 22, 1884; bred by Mr. N. Whitley, Green Royd, Halifax; *s.* "Young Duke" (195); *d.* "Kitty."

Nos. 1787 and 1788 were *Highly Commended.*

Class 153.—*Breeding Sow Pigs, farrowed in the Year* 1888. *Pens of Three.* [4 entries.]

1790 THE EARL OF ELLESMERE, Worsley Hall, Manchester: FIRST PRIZE, 10*l.*; were farrowed January 5; bred by himself; *s.* "Silver Crown;" *d.* by "King William" (593).

1793 TOM D. STRICKLAND, Stud Farm, Thirsk Junction, Yorkshire SECOND PRIZE, 5*l.*; were farrowed January 12; bred by himself.

Small White Breed.

Class 154.—*Boars farrowed in the Year* 1887. [7 entries.]

1799 THE EARL OF ELLESMERE, Worsley Hall: FIRST PRIZE, 10*l.*; was farrowed January 6; bred by himself; *s.* "Worsley Hero 4th;" *d.* "Worsley Belle" (988).

1798 THE HON. MRS. MEYNELL INGRAM, Temple Newsam, Leeds: SECOND PRIZE, 5*l.*, for "Young Masher;" was farrowed February 2; bred by herself.

1797 THE EARL OF RADNOR, Coleshill House, Highworth: the *Reserve Number* and *Highly Commended*; was farrowed June 25; bred by himself; *s.* "Peter;" *d.* "Lady Emily" (964), by "Cromwell."

Class 155.—*Boar Pigs, farrowed in the Year* 1888. *Pens of Three.* [3 entries.]

1802 The Earl of Ellesmere, Worsley Hall, Manchester: First Prize, 10*l.*; were farrowed January 6; bred by exhibitor; *s.* "Silver Crown" (397); *d.* by "The Swell" (249).

1801 Adolphus Hulme Slade, Castle Hill, Addington, Croydon, Surrey: Second Prize, 5*l.*; were farrowed January 4; bred by himself; *s.* "Garibaldi" (403); *d.* "Beauty" (522), by "Warwick."

Class 156.—*Breeding Sows, farrowed previously to, or in the Year* 1887. [9 entries.]

1809 The Hon. Mrs. Meynell Ingram, Temple Newsam, Leeds: First Prize, 10*l.*, for "Duchess;" was farrowed August 22, 1886; bred by herself.

1808 The Hon. Mrs. Meynell Ingram: Second Prize, 5*l.*, for "Princess;" was farrowed August 22, 1886; bred by herself.

1810 F. A. Walker-Jones, Little Mollington, Chester: the *Reserve Number* and *Highly Commended*; was farrowed November 21, 1884; bred by himself; *s.* "Roger;" *d.* "Snowdrop" (264), by "Curly."

Nos. 1805, 1807, and 1811 were *Highly Commended.*

Class 157.—*Breeding Sow Pigs, farrowed in the Year* 1888.—*Pens of Three.* [2 entries.]

1813 The Earl of Radnor, Coleshill House, Highworth: First Prize, 10*l.*; were farrowed February 4; bred by himself; *s.* "Clanfield;" *d.* "Shaftesbury," by "Gentleman."

Berkshire.

Class 158.—*Boars farrowed in the Year* 1887. [5 entries.]

1817 Alfred E. W. Darby, Little Ness, Shrewsbury: First Prize, 10*l.*, for "Terrick Prince;" was farrowed in January, 1887; bred by the late Mr. L. Ponsonby, Terrick Farm, Tring; *s.* "Royal Duke;" *d.* "Terrick Maid," by "Speculation" (151).

1815 Arthur S. Gibson, Springhill, Bulwell, Nottinghamshire: Second Prize, 5*l.*, for "Knight Errant;" was farrowed March 26; bred by himself; *s.* "Speculation" (151); *d.* "Worcester 15th" (664), by "Wizard 5th.

1816 John Pittman King, North Stoke, Wallingford, Berkshire: the *Reserve Number* and *Commended*, for "Tankerville;" was farrowed March 20; bred by himself; *s.* "Tinker 3rd" (978); *d.* "Ruby" (736), by "Samphire" (69).

Class 159.—*Boar Pigs, farrowed in the Year* 1888.—*Pens of Three.* [4 entries.]

1823 Nathaniel Benjafield, Short's Green Farm, Motcomb, Shaftesbury, Dorset: First Prize, 10*l.*; were farrowed January 2; bred by Mr. E. Drew, Marnhull, Blandford, Dorset.

1822 Alfred E. W. Darby, Little Ness, Shrewsbury: Second Prize, 5*l.*; were farrowed January 24; bred by himself; *s.* "Terrick Prince;" *d.* "Prescot Maid" (1050), by "Speculation" (151).

Class 160.—*Breeding Sows, farrowed previously to or in the Year* 1887. [16 *entries.*]

1834 ALFRED E. W. DARBY, Little Ness: FIRST PRIZE, 10*l.*, for "Trafford Maid;" was farrowed December 20, 1886; bred by himself; *s.* "Lord Conyers" (122); *d.* "Adcote Maid" (155), by "Potentate" (414).

1839 NATHANIEL BENJAFIELD, Short's Green Farm, Motcombe, Shaftesbury: SECOND PRIZE, 5*l.*, for "Blanche;" was farrowed June 11, 1886; in-pig; bred by Mr. J. P. Andrews; *s.* "Speculation;" *d.* "Queen of the Isles" (1375), by "Bingley Lad 2nd" (34).

1830 JOHN PITTMAN KING, North Stoke, Wallingford, Berks: THIRD PRIZE, 3*l.*, for "Lady Dorchester;" was farrowed January 29, 1887; in-pig; bred by Mr. G. F. Vincent, Compton Vallence, Dorchester; *s.* "Sampler" (1281); *d.* "Compton," by "Prince."

1832 ALFRED E. W. DARBY, Little Ness: the *Reserve Number* and *Highly Commended*, for "Patty;" was farrowed February 14, 1887; in-pig; bred by himself; *s.* "Lord Conyers (122); *d.* "Preference" (1382), by "Speculation" (151).

Nos. 1826, 1829, 1833, 1837, and 1838 were *Highly Commended.*

Nos. 1824, 1825, 1828, 1831, 1835, and 1836 were *Commended.*

Class 161.—*Breeding Sow Pigs, farrowed in the Year* 1888. *Pens of Three.* [6 entries.]

1843 THOMAS STEPHEN MINTON, Montford. Shropshire: FIRST PRIZE, 10*l.*; were farrowed January 4; bred by himself; *s.* "Wicket Keeper" (860); *d.* "Fatty" (1400), by "Speculation" (151).

1841 ALFRED E. W. DARBY, Little Ness: SECOND PRIZE, 5*l.*; were farrowed January 24; bred by himself; *s.* "Terrick Prince;" *d.* "Prescot Maid" (1050), by "Speculation" (151).

1844 NATHANIEL BENJAFIELD, Short's Green Farm, Motcombe: the *Reserve Number*; were farrowed January 2; bred by himself.

Any other Black Breed.

Class 162.—*Boars farrowed in the Year* 1887. [5 entries.]

1846 GEORGE PETTIT, The Firs, Friston, Saxmundham, Suffolk: FIRST PRIZE, 10*l.*, for "Jack" (Suffolk), was farrowed July 17; bred by himself; *s.* "Danger;" *d.* "Victoria."

1847 GEORGE PETTIT: SECOND PRIZE, 5*l.*, for "Peter" (Suffolk); was farrowed July 17; bred by himself; *s.* "Danger;" *d.* "Victoria."

1848 JOSEPH ALFRED SMITH, Rise Hall, Akenham, Ipswich, Suffolk: the *Reserve Number* and *Commended*, for "Harold" (Suffolk); was farrowed May 1; bred by himself; *s.* "Shamrock;" *d.* "Expectation" (52), by "Parnell" (45).

Class 163.—*Boar Pigs, farrowed in the Year* 1888.—*Pens of Three.* [3 entries.]

1851 GEORGE PETTIT, The Firs, Friston, Saxmundham: FIRST PRIZE, 10*l.*, for "Three Gipsies" (Suffolk); were farrowed January 12; bred by himself; *s.* "Gipsy King;" *d.* "Rose."

1853 The Duke of Hamilton and Brandon, K.T., Easton Park, Wickham Market, Suffolk: Second Prize, 5*l.*, for his small blacks; were farrowed March 6; bred by himself; *s.* "Tommy" (455); *d.* "Princess" (618), by "Young Robert."

1852 Joseph Alfred Smith, Rise Hall, Akenham: the *Reserve Number* and *Commended*, for his Suffolks; were farrowed April 3; bred by himself; *s.* "Shamrock;" *d.* "Expectation" (52), by "Parnell" (45).

Class 164.—*Breeding Sows, farrowed previously to or in the Year* 1887. [5 entries.]

1855 George Pettit, The Firs, Friston: First Prize, 10*l.*, for "Polly" (Suffolk); was farrowed January 10, 1887; bred by himself; *s.* "Danger;" *d.* "Nancy."

1854 George Pettit: Second Prize, 5*l.*, for "Primrose" (Suffolk); was farrowed June 6, 1886; bred by himself; *s.* "Danger;" *d.* "Ann."

1856 Joseph Alfred Smith, Rise Hall, Akenham: the *Reserve Number*, for "Florence" (Suffolk); was farrowed in June, 1886; in-pig; bred by Mr. H. Biddell, Playford, Ipswich.

Class 165.—*Breeding Sow Pigs, farrowed in the Year* 1888. *Pens of Three.* [2 entries.]

1860 The Duke of Hamilton and Brandon, K.T., Easton Park, Wickham Market: First Prize, 10*l.*, for his small blacks; were farrowed January 6; bred by himself; *s.* "Tommy" (455); *d.* "Gipsy" (614), by "Robert the Devil."

1859 George Pettit, The Firs, Friston: the *Reserve Number* and *Commended*, for "Three Duchesses" (Suffolk); were farrowed February 1; bred by himself; *s.* "Tommy;" *d.* "Jane."

Tamworth.

Class 166.—*Boars farrowed in the Year* 1887. [7 entries.]

1864 The Aylesbury Dairy Company, Limited, Horsham, Sussex: First Prize, 10*l.*, for "Joseph;" was farrowed August 2; bred by themselves; *s.* "Moses;" *d.* "Tamworth Lass 4th," by "Peeping Tom" (419).

1867 William Henry Mitchell, Elmdene, Kenilworth, Warwickshire: Second Prize, 5*l.*, for "Nepos;" was farrowed June 4; bred by himself; *s.* "Napoleon;" *d.* "Sylvia."

1865 The Aylesbury Dairy Company, Limited, Horsham: the *Reserve Number* and *Highly Commended*, for "Jacob;" was farrowed August 10; bred by themselves; *s.* "Moses;" *d.* "Lady Foster Preston," by "The Peeler" (433).

No. 1866 was *Highly Commended.*

Class 167.—*Boar Pigs, farrowed in the Year* 1888.—*Pens of Three.* [7 entries.]

1873 R. N. Sutton-Nelthorpe, Scawby Hall, Brigg, Lincolnshire: First Prize, 10*l.*; were farrowed January 5; bred by himself.

1869 John Norman, Jun., Cliff House, Tamworth; and Joseph Norman, Nether Whitacre, Coleshill: Second Prize, 5*l.*; were farrowed January 6; bred by Mr. Joseph Norman; *s.* "Curly" (633); *d.* "Sally" (564), by "Redskin" (421).

1871 The Aylesbury Dairy Company, Limited, Horsham: the *Reserve Number* and *Highly Commended*; were farrowed February 23; bred by themselves; *s.* "Solomon;" *d.* "Last Chance," by "The Peeler" (433).

Class 168.—*Breeding Sows, farrowed previously to or in the Year* 1887. [4 entries.]

1878 Thomas Watson, Whitacre Hall, Coleshill, Warwickshire: First Prize, 10*l.*, for "Whitaker Queen 2nd;" was farrowed in June 1887; bred by himself; *s.* "Tamworth Hero;" *d.* "Whitacre Queen 1st," by "Old Sampson."

1876 William Henry Mitchell, Elmdene: Second Prize, 5*l.*, for "Sylvia 2nd;" was farrowed June 14, 1884; bred by himself; *s.* "Sampson;" *d.* "Sylvia."

1875 William Henry Mitchell: the *Reserve Number* and *Highly Commended*; was farrowed June 17, 1887; in-pig; bred by himself; *s.* "Samuel;" *d.* "Stoney."

Class 169.—*Breeding Sow Pigs, farrowed in the Year* 1888. *Pens of Three.* [8 entries.]

1880 John Norman, Jun., Cliff House, Tamworth; and Joseph Norman, Nether Whitacre, Coleshill: First Prize, 10*l.*; were farrowed January 15; bred by John Norman, Jun.; *s.* "Newcastle Hero;" *d.* "Newcastle Heroine," by "The Squire" (649).

1885 R. N. Sutton-Nelthorpe, Scawby Hall, Brigg, Lincolnshire: Second Prize, 5*l.*; were farrowed January 10; bred by himself.

1883 The Aylesbury Dairy Company, Limited, Horsham: the *Reserve Number*; were farrowed March 2; bred by themselves; *s.* "Dickie" (635); *d.* "Preston Tamworth Lass 3rd" (1018), by "The Peeler" (433).

CHEESE.

Class 170.—*Three Cheddar Cheeses, not less than* 50 *lbs. each, made in the Year* 1887. [11 entries.]

1 Thomas Allen, Crookwood, Devizes, Wilts: First Prize, 20*l.*

9 Edwin Hiscock, Ashley Farm, Marnhull, Blandford, Dorset: Second Prize, 10*l.*

2 Thomas Allen, Crookwood: Third Prize, 5*l.*

7 John Hillard, Hook Farm, Stoke Trister, Wincanton: the *Reserve Number* and *Very Highly Commended.*

Nos. 10 and 11 were *Highly Commended.*

Nos. 4, 5, and 8 were *Commended.*

Class 171.—*Three Cheshire Cheeses, of not less than* 40 *lbs. each, made in the Year* 1887. [13 entries.]

16 THOMAS HOULBROOKE, Calveley Farm, Tarporley: FIRST PRIZE, 20*l.*

20 JOHN LEE, The Crimps, Ellesmere, Salop: SECOND PRIZE, 10*l.*

14 HUGH R. DUTTON, Spurston Lower Hall, Tarporley: THIRD PRIZE, 5*l.*

22 WILLIAM NODEN, Wittenhall, Winsford: the *Reserve Number* and *Very Highly Commended.*

No. 17 was *Highly Commended.*

Nos. 15 and 21 were *Commended.*

Class 172.—*Six Stilton Cheeses, made in the Year* 1887. [15 entries.]

36 HENRY MORRIS, Manor Farm, Saxelby, Melton Mowbray: FIRST PRIZE, 20*l.*

37 HENRY MORRIS, Manor Farm, Saxelby: SECOND PRIZE, 10*l.*

28 MRS. FAIRBROTHER, Beeby, Leicester: THIRD PRIZE, 5*l.*

27 MR. COLEMAN, Long Clawson, Melton Mowbray: the *Reserve Number* and *Very Highly Commended.*

No. 33 was *Highly Commended.*

Nos. 25, 26, 34, and 35 were *Commended.*

Class 173.—*Three Cheeses of any British make, made in the Year* 1888. [41 entries.]

47 HENRY CANNON, Milton, Cleveden, Evercreech, Somerset: FIRST PRIZE, 20*l.*

71 HENRY MORRIS, Saxelby, Melton Mowbray: SECOND PRIZE, 10*l.*

65 THOMAS HOULBROOKE, Calveley Farm, Tarporley: THIRD PRIZE, 5*l.*

48 HENRY CANNON, Milton: the *Reserve Number* and *Very Highly Commended.*

Nos. 46, 63, 64, and 66 were *Highly Commended.*

Nos. 56, 57, 58, 59, 72, and 75 were *Commended.*

Class 174.—*Four Derbyshire or Leicestershire Cheeses, not less than* 30 *lbs. each, made in the Year* 1888.* [8 entries.]

83 JOHN W. FOWLER, Donisthorpe, Ashby-de-la-Zouch: FIRST PRIZE, 10*l.*

86 WILLIAM GILMAN, The Cheese Factory, Rocester, Stafford: SECOND PRIZE, 5*l.*

81 THE CROXDEN CHEESE FACTORY COMPANY, Croxden, Uttoxeter: the *Reserve Number* and *Very Highly Commended.*

No. 88 was *Highly Commended.*

No. 85 was *Commended.*

Class 175.—*Four Derbyshire or Leicestershire Cheeses, not less than* 20 *lbs. and under* 30 *lbs. each, made in the Year* 1888.* [10 entries.]

91 J. W. FOWLER, Donisthorpe, Ashby-de-la-Zouch: FIRST PRIZE, 10*l.*

92 WILLIAM GILMAN, The Cheese Factory, Rocester, Stafford: SECOND PRIZE, 5*l.*

98 John Robinson, White Meadow Farm, Bradbourne, Wirksworth, Derbyshire: the *Reserve Number* and *Very Highly Commended.*

No. 94 was *Highly Commended.*

Nos. 93 and 96 were *Commended.*

Class 176.—*Four Trent Bank Cheeses, made in the Year* 1888.*
[No entries.]

Soft Cheese.

Class 177.—*Three Cream Cheeses.* [11 entries.]

99 Edwin Brough, Wyndyate, Scarborough, Yorkshire: First Prize, 3*l.*

101 William H. Davis, Holme House, Gargrave, Yorkshire: Second Prize, 2*l.*

100 Richard Colley, Sylfam, Welshpool, Montgomeryshire: Third Prize, 1*l.*

102 Robert F. Earle, The Grange, Barham, Huntingdon: the *Reserve Number* and *Highly Commended.*

Class 178.—*Eight Colwick Cheeses.** [No entries.]

Class 179.—*Three Soft Cheeses other than Colwick.** [6 entries.]
(No Merit.)

BUTTER.

Class 180.—*Three Pounds of Fresh Butter, absolutely free from Salt.* [51 entries.]

41 Mrs. Peel, Thornton Hall, Stony Stratford, Bucks: First Prize, 5*l.*

37 William E. Mudd, Slade House, Thornthwaite, Ripley, Yorkshire: Second Prize, 3*l.*

29 Mrs. Horton, Crumleigh Heath, Little Leigh, Northwich, Cheshire: Third Prize, 2*l.*

10 Thomas Davies, Pont-faen Farm, Rhuddlan, Rhyl, Flintshire: Fourth Prize, 1*l.*

51 William Winter, Highberries, Carlisle: the *Reserve Number* and *Highly Commended.*

Nos. 8, 5, 11, 12, 21, 22, 32, 36, 40, and 48 were *Highly Commended.*

Nos. 4, 14, 17, 27, 31, 33, 34, 38, and 43 were *Commended.*

Class 181.—*Three Pounds of Fresh Butter, slightly salted.**
[55 entries.]

94 Mrs. Peel, Thornton Hall, Stony Stratford, Bucks: First Prize, 5*l.*

106 William Winter, Highberries, Carlisle: Second Prize, 3*l.*

67 Mrs. Dobson, Greens Burn, Brampton, Cumberland: Third Prize, 2*l.*

60 William Burns, Victoria House, Witton-le-Wear, Co. Durham: Fourth Prize, 1*l.*

90 William E. Mudd, Slade House, Thornthwaite, Ripley, Yorkshire: the *Reserve Number* and *Highly Commended.*

Nos. 56, 57, 63, 65, 66, 71, 73, 75, 81, 85, 89, and 93 were *Highly Commended.*

Nos. 52, 54, 55, 61, 69, 74, 77, 78, 79, 83, 84, 95, 96, 101, and 102 were *Commended.*

Class 182.—*Three Pounds of Fresh Butter, slightly salted; made by a Member of a Farmer's Family.** [32 entries.]

137 Michael J. Williams, North Hill Farm, Chew Stoke, Somerset: First Prize, 5*l.*

133 Frederick C. Paine, Hengrave Mill, Bury St. Edmund's: Second Prize, 3*l.*

138 William Winter, Highberries, Carlisle: Third Prize, 2*l.*

112 Mrs. Dobson, Greens Burn, Lanercost, Cumberland: Fourth Prize, 1*l.*

128 Joseph Hayward Kemp, Walton, Wellington, Salop: the *Reserve Number* and *Highly Commended.*

Nos. 109, 126, and 131 were *Highly Commended.*

Nos. 108, 110, 111, 116, 117, 119, 120, 121, 123, 127, 129, and 130 were *Commended.*

Class 183.—*One Keg or other Package of Salt Butter, not less than 14 lbs. in weight.* [19 entries.]

141 Richard Colley, Sylfam, Welshpool, Montgomeryshire: First Prize, 5*l.*

150 Henry Hodson, Smeatonwood, Wrenbury, Nantwich, Cheshire: Second Prize, 3*l.*

144 Mrs. Dobson, Greens Burn, Lanercost, Brampton, Cumberland; Third Prize, 2*l.*

153 John Swan, Stonefield, Lincoln: Fourth Prize, 1*l.*

142 Thomas Davies, Pont-faen Farm, Rhuddlan, Flintshire: the *Reserve Number* and *Highly Commended.*

Nos. 152 and 154 were *Commended.*

HIVES, HONEY, AND BEE APPLIANCES.

Prizes and Medals given by the British Bee-Keepers' Association.

Class 184.—*Collections of Hives and Appliances.* [10 entries.]

7 Neighbour & Son, 127 High Holborn and 149 Regent Street, London. First Prize, 1*l.*, and Silver Medal.

5 J. H. Howard, Holme, Peterborough: Second Prize, 10*s.*, and Bronze Medal.

No. 3 was *Highly Commended.*

Class 185.—*The most complete Frame Hives for general use; price not to exceed* 15s., *unpainted.* [15 entries.]

22 Charles Redshaw, South Wigston, Leicester: First Prize, 1*l.*
13 Abbott Brothers, Southall, Middlesex: Second Prize, 15*s.*
11 T. B. Blow, Welwyn, Herts: Third Prize, 10*s.*
Nos. 19 and 25 were *Highly Commended.*

Class 186.—*The most complete Frame Hives for general use; price not to exceed* 10*s.* 6*d. unpainted.* [15 entries.]

38 Charles Redshaw: First Prize, 1*l.*
26 W. B. Baker, Muskham, Newark: Second Prize, 15*s.*
33 Messrs. Turner & Son, Radcliffe-on-Trent: Third Prize, 10*s.*

Class 187.—*Honey Extractors, with arrangements for reversing the sides of Combs.* [8 entries.]

44 W. P. Meadows, Syston, Leicester: First Prize, 15*s.*
42 J. H. Howard: Second Prize, 10*s.*
No. 41 was *Highly Commended.*

Class 188.—*Two Section Racks complete; price not to exceed* 3*s.* 6*d.* [17 entries.]

57 Neighbour & Son: First Prize, 15*s.*
50 T. B. Blow: Second Prize, 10*s.*
53 J. H. Howard: Third Prize, 5*s.*
No. 63 was *Highly Commended.*

Class 189.—*Feeders for slow stimulating feeding; price not to exceed* 1*s.* 6*d.* [8 entries.]

68 W. P. Meadows: First Prize, 10*s.*
71 Charles Redshaw: Second Prize, 5*s.*
No. 72 was *Very Highly Commended.*

Class 190.—*Feeders for quick Autumn feeding; price not to exceed* 3*s.* [9 entries.]

79 W. P. Meadows: First Prize, 10*s.*
76 J. H. Howard: Second Prize, 5*s.*

Class 191.—*Smokers filled with the Fuel to be used.* [13 entries.]

90 Neighbour & Son: First Prize, 10*s.*
92 W. Dixon, 5 Becket Street, Leeds: Second Prize, 5*s.*
No. 87 was *Highly Commended.*

Class 192.—*Useful Inventions introduced since* 1886.

121 A. Godman, St. Albans: Silver Medal.
108 J. H. Howard: Silver Medal.

114 Neighbour & Son: Silver Medal.

101 J. H. Howard: Bronze Medal.

Nos. 97, 100, 104, 110, and 125 were awarded certificates.

Class 193.—*Twelve Sections of Comb Honey,* $5\frac{1}{4}$ *by* $6\frac{1}{4}$. [12 entries.]

131 Sells & Son, Uffington: First Prize, 1*l.*

128 H. Beswick, Tibenham, Long Stratton: Second Prize, 10*s.*

Class 194.—*Twelve Sections of Comb Honey,* $4\frac{1}{4}$ *by* $4\frac{1}{4}$ *by* 2. [32 entries.]

152 Charles Atkinson, Tockwith, York: First Prize, 1*l.*

146 H. Beswick: Second Prize, 10*s.*

150 Sells & Son: Third Prize, 5*s.*

Class 195.—*Twelve Sections of Comb Honey,* $4\frac{1}{4}$ *by* $4\frac{1}{4}$ *(width optional).* [18 entries.]

173 H. Beswick: First Prize, 1*l.*

178 Sells & Son: Second Prize, 10*s.*

181 W. Woodley, World's End, Newbury: Third Prize, 5*s.*

Class 196.—*Run or Extracted Honey, in Twenty-four 1-lb. Glass Jars.* [36 entries.]

197 A. Simpson, Mansfield Woodhouse: First Prize, 1

191 J. H. Howard: Second Ppize, 10*s.*

199 H. Beswick: Third Prize, 5*s.*

Class 197.—*Run or Extracted Honey, in Twelve 2-lb. Glass Jars.* [21 entries.]

228 J. H. Howard: First Prize, 1*l.*

225 A. Simpson: Second Prize, 10*s.*

226 H. Beswick: Third Prize, 5*s.*

Class 198.—*Best Exhibition of Honey from one Apiary, not less than* 1 *cwt.* [11 entries.]

246 A. Simpson: First Prize, 1*l.* 10*s.*

255 J. R. Truss, Ufford Heath, Stamford: Second Prize, 1*l*

248 Sells & Sons: Third Prize, 10*s.*

Class 199.—*English Bees' Wax, not less than* 14 *lbs.* [6 entries.]

257 T. B. Blow: First Prize, 1*l.*

256 Abbott Brothers: Second Prize, 10*s.*

No. 260 was *Highly Commended.*

Class 200.—*The best and most complete Set of Apparatus required for making Comb foundations from Bees' Wax, as imported or otherwise.*

262 J. H. Howard, Holme, Peterborough: First Prize, 1*l.* and Silver Medal.

264 A. Godman, St. Albans: Second Prize, 10*s.*, and Bronze Medal.

Class 201.—*The best and most ready way of Testing the Purity of Bees' Wax.*

(Prizes withheld for further trial.)

Class 202.—*The most interesting and attractive Exhibit of any kind connected with Bee Culture not mentioned in the foregoing Classes.*

271 Abbott Brothers: First Prize. Silver Medal.

276 A. Watkins, Imperial Mills, Hereford: Second Prize, Bronze Medal.

Nos. 272 and 277 were *Highly Commended.*

POULTRY.

By "Cocks," "Hens," "Drakes," "Ducks," "Ganders," and "Geese," are meant birds hatched previous to January 1, 1888, and by "Cockerels," "Pullets," "Young Drakes," and "Ducklings,' are meant birds hatched in 1888, previous to June 1.

Fowls.

Class 1.—*Dark Brahma Cock and One Hen.* [10 entries.]

8 John Taylor, Alsagar, Stoke-on-Trent: First Prize, 3*l.*

6 Messrs. Pilling & Lord, Healey Dell, Rochdale: Second Prize, 2*l.*

7 John Taylor: Third Prize, 1*l.*

4 Horace Lingwood, Creeting, Wickham Market: the *Reserve Number* and *Highly Commended.*

No. 2 was *Highly Commended.*

Class 2.—*Dark Brahma Cockerel and One Pullet.* [6 entries.]

13 Charles D. Jones, Bryn-y-mor, Hastings: First Prize, 3*l.*

14 Horace Lingwood, Creeting: Second Prize, 2*l.*

15 John Taylor, Alsagar: Third Prize, 1*l.*

16 John Taylor: the *Reserve Number.*

No. 12 was *Commended.*

Class 3.—*Light Brahma Cock and One Hen.* [5 entries.]

17 William Cannan, Norwood, Cross Hills, Leeds: First Prize, 3*l.*

18 George T. Melbourne, Nocton Heath, Lincoln: Second Prize, 2*l.*

19 John Mitchell, Elmdene, Kenilworth: Third Prize, 1*l.*

Class 4.—*Light Brahma Cockerel and One Pullet.* [2 entries.]

23 THE REV. HAROLD BURTON, Fauls Vicarage, Whitchurch, Salop: FIRST PRIZE, 3*l.*

22 THE REV. HAROLD BURTON: SECOND PRIZE, 2*l.*

Class 5.—*Coloured Dorking Cock and One Hen.* [6 entries.]

28 BUTLER SMITH, The Grove, Cropwell Butler, Nottingham: FIRST PRIZE, 3*l.*

26 ANDREW CRICHTON, Glamis, Forfarshire: SECOND PRIZE, 2*l.*

24 JAMES CRANSTON, Tinwald House, Dumfries, N.B.: THIRD PRIZE, 1*l.*

29 BUTLER SMITH, Cropwell Butler: the *Reserve Number* and *Highly Commended.*

No. 25 was *Highly Commended.*

Class 6.—*Coloured Dorking Cockerel and One Pullet.* [10 entries.]

31 ROBERT B. CURTEIS, Ashenden, Tenterden, Kent: FIRST PRIZE, 3*l.*

37 BUTLER SMITH, Cropwell Butler: SECOND PRIZE, 2*l.*

38 BUTLER SMITH: THIRD PRIZE, 1*l.*

32 ROBERT B. CURTEIS: the *Reserve Number* and *Highly Commended.*

No. 39 was *Highly Commended.*

Class 7.—*Silver Grey Dorking Cock and One Hen.* [9 entries].

43 WILLIAM CANNAN, Norwood, Crosshills: FIRST PRIZE, 3*l.*

44 WILLIAM ROE, Jun., North Scarle Field, Newark-on-Trent: SECOND PRIZE, 2*l.*

42 JAMES CRANSTON, Tinwald House: THIRD PRIZE, 1*l.*

46 THOMAS ROME, Charlton House, Cheltenham: the *Reserve Number* and *Highly Commended.*

No. 41 was *Highly Commended.*

No. 47 was *Commended.*

Class 8.—*Silver Grey Dorking Cockerel and One Pullet.* [11 entries.]

54 JAMES ROBERTSON, Home Farm, Gordon Castle, Fochabers, N.B.: FIRST PRIZE, 3*l.*

52 JAMES CRANSTON, Tinwald House: SECOND PRIZE, 2*l.*

51 JAMES CRANSTON: THIRD PRIZE, 1*l.*

55 JAMES ROBERTSON: the *Reserve Number* and *Highly Commended.*

No. 56 was *Highly Commended.*

No. 59 was *Commended.*

Class 9.—*Any other Variety Dorking Cock and One Hen.* [6 entries.]

63 JOHN MITCHELL, Kenilworth: FIRST PRIZE, 3*l.*

65 PETER WILSON, Colvinston, Annbank, Ayrshire: SECOND PRIZE, 2*l.*

60 ALFRED E. W. DARBY, Little Ness, Shrewsbury: THIRD PRIZE, 1*l.*

64 JOHN E. PILGRIM, The Shade, Sharnford, Hinckley: the *Reserve Number* and *Highly Commended.*

No. 61 was *Highly Commended.*

Class 10.—*Any other Variety Dorking Cockerel and One Pullet.* [2 entries.]

67 CHARLES A. GOSNELL, The Park, Feltham Hill, Middlesex: FIRST PRIZE, 3*l.*

66 ALFRED E. W. DARBY: SECOND PRIZE, 2*l.*

Class 11.—*Cochin Cock and One Hen (any variety).* [6 entries.]

69 MRS. H. J. GOODALL, The Priory, Melton Mowbray: FIRST PRIZE, 3*l.*

72 GEORGE H. PROCTOR, Flass House, Durham: SECOND PRIZE, 2*l.*

70 MRS. H. J. GOODALL: THIRD PRIZE, 1*l.*

73 GEORGE H. PROCTOR: the *Reserve Number* and *Highly Commended.*

Class 12.—*Cochin Cockerel and One Pullet (any variety).* [3 entries.]

74 MRS. BARTON, Warton Grange, Carnforth, Lancashire: FIRST PRIZE, 3*l.*

76 MRS. H. J. GOODALL: SECOND PRIZE, 2*l.*

75 MRS. H. J. GOODALL: THIRD PRIZE, 1*l.*

Class 13.—*Langshan Cock and One Hen.* [20 entries.]

83 THE REV. ARTHUR C. DAVIES, Oldborough Rectory, Hanworth, S.O., Norwich: FIRST PRIZE, 3*l.*

87 ROBERT J. POPE, Woodside, Barcombe, Lewes: SECOND PRIZE, 2*l.*

84 THE REV. ARTHUR C. DAVIES: THIRD PRIZE, 1*l.*

95 S. & W. WILSON, 8 Northgate, Newark-on-Trent: the *Reserve Number* and *Highly Commended.*

Nos. 85, 86, and 88 were *Highly Commended.*

Nos. 77 and 92 were *Commended.*

Class 14.—*Langshan Cockerel and One Pullet.* [7 entries.]

97 C. ABRAHAM & J. A. HORSFORD, Elm House, Long Melford, Suffolk: FIRST PRIZE, 3*l.*

102 DR. G. C. SEARLE, Burton House, Brixham, Devon: SECOND PRIZE, 2

101 R. J. POPE: THIRD PRIZE, 1*l.*

98 THE AYLESBURY DAIRY COMPANY, Horsham, Sussex: the *Reserve Number* and *Highly Commended.*

No. 103 was *Commended.*

Class 15.—*Houdan Cock and One Hen.* [10 entries.]

104 JOHN AINSWORTH, High Bank, Darwen, Lancashire: FIRST PRIZE, 3*l.*

112 SAMUEL W. THOMAS, Glasfryn, Cockett, Swansea: SECOND PRIZE, 2*l.*

113 Samuel W. Thomas: Third Prize, 1*l.*

107 Mrs. Irving, Edentown, Carlisle: the *Reserve Number* and *Commended.*

Class 16.—*Houdan Cockerel and One Pullet.* [6 entries.]

119 The Rev. R. S. Mitchison, Barby Rectory, Rugby, Warwickshire: First Prize, 3*l.*

118 The Rev. R. S. Mitchison: Second Prize, 2*l.*

117 Mrs. Irving: Third Prize, 1*l.*

116 Mrs. C. Hill, Queen's Gate, Cheltenham: the *Reserve Number.*

Class 17.—*Crèvecœur Cock and One Hen.* [8 entries.]

124 John L. Holden, Simonstone, Padiham, Lancashire: First Prize, 3*l.*

125 John Meikle, Mount Hamilton, Ayr, N.B.: Second Prize, 2*l.*

123 John L. Holden: Third Prize, 1*l.*

122 John S. Calvert, Keighley, Yorkshire: the *Reserve Number* and *Highly Commended.*

No. 121 was *Highly Commended.*

Class 18.—*Crèvecœur Cockerel and One Pullet.* [1 entry.]
[No Award.]

Class 19.—*Andalusian Cock and One Hen.* [10 entries.]

132 Halliwell & Finch, 15 Heatley Street, Preston: First Prize, 3*l.*

133 Samuel Hawes, High Street, Datchet, Windsor: Second Prize, 2*l.*

131 The Rev. Ernest R. O. Bridgeman, Blymhill Rectory, Shifnal: Third Prize, 1*l.*

137 Edwin Merrall, Morton, Bingley, Yorks: the *Reserve Number* and *Highly Commended.*

Nos. 129 and 134 were *Commended.*

Class 20.—*Andalusian Cockerel and One Pullet.* [9 entries.]

146 Edwin Merrall: First Prize, 3*l.*

145 William Leighton, Bridge Street, Preston: Second Prize, 2*l.*

147 Thomas Simon, Castle Hill Farm, Market Drayton, Salop: Third Prize, 1*l.*

141 David Butterfield, 3 Laythorpe Terrace, East Morton, Bingley, Yorks: the *Reserve Number* and *Highly Commended.*

No. 140 was *Highly Commended.*

Class 21.—*Minorca Cock and One Hen.* [12 entries.]

157 Arthur G. Pitts, The Firs, Highbridge, Somerset: First Prize, 3*l.*

158 Job Rawnsley, Langley Farm, Bingley, Yorks: Second Prize, 2*l.*

149 William John Amesbury, 37 Langton Street, Cathay, Bristol: Third Prize, 1*l.*

154 George A. Gibbons, Market Place, Alford, Lincolnshire: the *Reserve Number* and *Highly Commended.*

No. 153 was *Highly Commended.*

Class 22.—*Minorca Cockerel and One Pullet.* [12 entries.]

164 Samuel Friend, 23 West Street, Tavistock, Devon: First Prize, 3*l.*

163 William T. Dorning, Milton Cottage, Chard, Somerset: Second Prize, 2*l.*

166 Michael W. Holmes, Stonegate Farm, Low Bentham, Yorkshire: Third Prize, 1*l.*

170 Edward Nelson, Wareham, Wells, Norfolk: the *Reserve Number* and *Highly Commended.*

No. 162 was *Highly Commended.*

Class 23.—*Leghorn Cock and One Hen.* [10 entries.]

176 William Cannan, Norwood, Crosshills, Leeds: First Prize, 3*l*

175 John Berry, 40 Aireview Street, Silsden, Leeds: Second Prize, 2*l.*

180 Joseph Pride, Thorverton, Devon: Third Prize, 1*l.*

178 William Laugher, Brynhyfryd, Cowbridge, Glamorganshire: the *Reserve Number* and *Highly Commended.*

No. 181 was *Highly Commended.*

Class 24.—*Leghorn Cockerel and One Pullet.* [9 entries.]

187 Joseph Pride: First Prize, 3*l.*

185 John Berry: Second Prize, 2*l.*

183 Albert Curzon Bradbury, Nuthall, Notts: Third Prize, 1*l.*

189 Dr. G. C. Searle, Burton House, Brixham, Devon: the *Reserve Number* and *Highly Commended.*

Class 25.—*Plymouth Rock Cock and One Hen.* [9 entries.]

195 John Hartley, Gillroyd, Morley, Yorkshire: First Prize, 3*l.*

192 Tom Batting, Upton Pyne, Exeter: Second Prize, 2*l.*

194 J. Steere Hardy, Gedling, Notts: Third Prize, 1*l.*

199 Miss Maxwell Stuart, Scarthingwell, Tadcaster, Yorkshire: the *Reserve Number* and *Highly Commended.*

Class 26.—*Plymouth Rock Cockerel and One Pullet.* [15 entries.]

213 Miss Maxwell Stuart: First Prize, 3*l.*

204 John L. Holden, Simonstone, Padiham, Second Prize, 2*l.*

206 L. & S. Jackson, Manor Farm, Ringway, Altrincham, Cheshire: Third Prize, 1*l.*

200 Abbott Brothers, Thuxton, Hingham, Norfolk: the *Reserve Number* and *Highly Commended.*

Nos. 201 and 204 were *Highly Commended.*

Nos. 203 and 209 were *Commended.*

Class 27.—*Scotch Grey Cock and One Hen.* [6 entries.]

220 MATTHEW SMITH, Townhead Farm, Thornhill, N.B.: FIRST PRIZE, 3*l.*

218 CLAUDE L. RALSTON, Glamis House, Glamis, N.B.: SECOND PRIZE, 2*l.*

217 ANDREW W. HENDERSON, Maryfield, Bridge of Allan, N.B.: THIRD PRIZE, 1*l.*

219 JOB RAWNSLEY, Langley Farm, Bingley, Yorkshire: the *Reserve Number* and *Highly Commended.*

Class 28.—*Scotch Grey Cockerel and One Pullet.* [5 entries.]

222 ALEXANDER HAMILTON, Braidwood, Carluke, Lanarkshire: FIRST PRIZE, 3*l.*

225 MATTHEW SMITH, Townhead Farm, Thornhill, N.B.: SECOND PRIZE, 2*l.*

224 CLAUDE L. RALSTON, Glamis: THIRD PRIZE, 1*l.*

221 W. STEPHEN BLACK, High Kettleby, Melton Mowbray: the *Reserve Number* and *Highly Commended.*

Class 29.—*Black Hamburgh Cock and One Hen.* [5 entries.]

228 T. C. HEATH, Sneyd Farm, Cobridge, Staffordshire: FIRST PRIZE, 3*l.*

229 JOB RAWNSLEY, Langley Farm, Bingley, Yorkshire: SECOND PRIZE, 2*l.*

230 ROBERT WILSON, Paradise, Morton, Bingley: THIRD PRIZE, 1*l.*

227 WILLIAM CANNAN, Norwood, Crosshills, Yorkshire: the *Reserve Number.*

Class 30.—*Black Hamburgh Cockerel and One Pullet.* [6 entries.]

236 ROBERT WILSON: FIRST PRIZE, 3*l.*

235 THOMAS RYMAN, Theale, Weston-super-Mare: SECOND PRIZE, 2*l.*

231 WILLIAM CANNAN: THIRD PRIZE, 1*l.*

232 T. C. HEATH: the *Reserve Number* and *Commended.*

Class 31.—*Any other Variety Hamburgh Cock and One Hen.* [9 entries.]

238 WILLIAM CANNAN: FIRST PRIZE, 3*l.*

237 MISS BERTHA BELDON, Cottingley Bridge House, Bingley: SECOND PRIZE, 2*l.*

243 JOB RAWNSLEY, Langley Farm, Bingley: THIRD PRIZE, 1*l.*

242 JOB RAWNSLEY: the *Reserve Number* and *Highly Commended.*

No. 241 was *Highly Commended.*

Class 32.—*Any other Variety Hamburgh Cockerel and One Pullet.* [8 entries.]

247 WILLIAM CANNAN: FIRST PRIZE, 3*l.*

248 HENRY DIGBY, The Burne, Birchencliffe, Huddersfield: SECOND PRIZE, 2*l.*

246 WILLIAM CANNAN: THIRD PRIZE, 1*l.*

252 ROBERT SISSON, Cross Hill, Stanhope, Co. Durham: the *Reserve Number* and *Highly Commended.*

No. 253 was *Highly Commended.*

Class 33.—*Black Red Game Cock and One Hen.* [9 entries.]

261 Samuel Matthew, The Elms, Stowmarket, Suffolk: First Prize, 3*l.*

257 The Hon. and Rev. F. Dutton, Bibury Vicarage, Fairford, Gloucestershire: Second Prize, 2*l.*

259 Captain Heaton, Worsley, Manchester: Third Prize, 1*l.*

260 Captain Heaton: the *Reserve Number* and *Highly Commended.*

Class 34.—*Black Red Game Cockerel and One Pullet.* [5 entries.]

266 Captain Heaton: First Prize, 3*l.*

267 Captain Heaton: Second Prize, 2*l.*

265 Arthur S. Gibson, Springhill, Bulwell, Notts: Third Prize, 1*l.*

264 Miss Bertha Beldon, Cottingley Bridge House, Bingley: the *Reserve Number.*

Class 35.—*Brown Red Game Cock and One Hen.* [5 entries.]

272 Samuel Matthew, The Elms, Stowmarket, Suffolk: First Prize, 3*l.*

269 Charles W. Brierley, Rosedale, Tenbury, Worcestershire: Second Prize, 2*l.*

268 Charles W. Brierley: Third Prize, 1*l.*

270 J. W. Brockbank, The Croft, Kirksanton, Cumberland: the *Reserve Number* and *Commended.*

Class 36.—*Brown Red Game Cockerel and One Pullet.* [No entry.]

Class 37.—*Any other Variety Game Cock and One Hen.* [3 entries.]

273 Charles W. Brierley: First Prize, 3*l.*

275 J. W. Brockbank: Second Prize, 2*l.*

274 Charles W. Brierley: Third Prize, 1*l.*

Class 38.—*Any other Variety Game Cockerel and One Pullet.* [3 entries.]

276 J. W. Brockbank: First Prize, 3*l.*

277 Joseph Colgrove, Winslow, Bucks: Second Prize, 2*l.*

Class 39.—*Cock and Hen of any other Variety.* [15 entries.]

289 Job Rawnsley, Langley Farm, Bingley, Yorkshire: First Prize, 3*l.*

287 John Powell, Hirst Mill, Saltaire, Yorkshire: Second Prize, 2*l.*

288 Job Rawnsley: Third Prize, 1*l.*

281 William Harpur Crewe, The Lawn, Etwall, Derby: the *Reserve Number* and *Highly Commended.*

Nos. 282 and 293 were *Highly Commended.*

Nos. 280 and 290 were *Commended.*

Class 40.—*Cockerel and One Pullet of any other Variety.* [10 entries.]

299 John C. Huxtable, 58 South Street, South Molton, Devon: First Prize, 3*l.*

295 Miss Bertha Beldon, Cottingley Bridge House, Bingley, Yorkshire: Second Prize, 2*l.*

298 MRS. FRANKLIN, Syston Old Hall, Grantham: THIRD PRIZE, 1*l.*

302 JOSHUA ROBERTS, 52 Kirkgate, Silsden, Leeds: the *Reserve Number* and *Highly Commended.*

No. 294 was *Commended.*

Ducks.

Class 41.—*Aylesbury Drake and One Duck.* [2 entries.]

305 THE AYLESBURY DAIRY COMPANY, Horsham, Sussex: FIRST PRIZE, 3*l.*

304 THOMAS ALLEN, Crookwood, Devizes, Wilts: SECOND PRIZE, 2*l.*

Class 42.—*Aylesbury Young Drake and one Duckling.* [5 entries.]

308 WILLIAM BYGOTT, Jun., Rye Hill Farm, Ulceby, Lincolnshire: FIRST PRIZE, 3*l.*

309 EDWARD NELSON, Warham, Wells, Norfolk: SECOND PRIZE, 2*l.*

306 THE AYLESBURY DAIRY COMPANY: THIRD PRIZE, 1*l.*

307 THE AYLESBURY DAIRY COMPANY: the *Reserve Number* and *Highly Commended.*

Class 43.—*Rouen Drake and One Duck.* [8 entries.]

311 WILLIAM BYGOTT, Jun.: FIRST PRIZE, 3*l.*

317 FRANCIS E. RICHARDSON, Holly Grange, Bramshall, Uttoxeter: SECOND PRIZE, 2*l.*

316 JOHN MITCHELL, Elmdene, Kenilworth, Warwickshire: THIRD PRIZE, 1*l.*

313 MRS. F. DAVIS, Woolashill, Pershore, Worcestershire: the *Reserve Number* and *Highly Commended.*

No. 318 was *Highly Commended.*

No. 314 was *Commended.*

Class 44.—*Rouen Young Drake and One Duckling.* [3 entries.]

319 WILLIAM BYGOTT, Jun., Rye Hill Farm, Ulceby, Lincolnshire: FIRST PRIZE, 3*l.*

320 WILLIAM BYGOTT, Jun.: SECOND PRIZE, 2*l.*

321 THOMAS WAKEFIELD, Golborne, Newton-le-Willows, Lancashire: THIRD PRIZE, 1*l.*

Class 45.—*Any other Variety Drake and One Duck.* [7 entries.]

322 THOMAS ALLEN, Crookwood, Devizes: FIRST PRIZE, 3*l.*

326 MRS. F. DAVIS, Woolashill: SECOND PRIZE, 2*l.*

323 THE AYLESBURY DAIRY COMPANY, Horsham: THIRD PRIZE, 1*l.*

327 MRS. MARY ANNE HAYNE, Fordington, Dorchester: the *Reserve Number* and *Highly Commended.*

Class 46.—*Any other Variety Young Drake and One Duckling.* [3 entries.]

330 HERBERT GRIFFITHS, The Rake, Hawarden, Flintshire: FIRST PRIZE, 3*l.*

331 ARTHUR MILNER, Sen., Stirthfield Farm, Stretton, Alfreton, Derbyshire: SECOND PRIZE, 2*l.*

327 THOMAS ALLEN, Crookwood: THIRD PRIZE, 1*l.*

Geese.

Class 47.—*Gander and One Goose.* [4 entries.]

332 JOHN EWART, Ellen Hall Mill, Cockermouth, Cumberland: FIRST PRIZE, 3*l.*

333 ARTHUR S. GIBSON, Springhill, Bulwell, Notts: SECOND PRIZE, 2*l.*

334 JOHN KERR, Red Hall, Wigton, Cumberland: THIRD PRIZE, 1*l.*

335 JOHN LLOYD, Astwick Manor, Hatfield, Herts: the *Reserve Number* and *Highly Commended.*

Turkeys.

Class 48.—*Black or Bronze Cock and One Hen.* [7 entries.]

342 MRS. WILLIAMS, Hawkstone Hotel, Shrewsbury: FIRST PRIZE, 3*l.*

338 EDWARD KENDRICK, Jun., Weeford House, Lichfield: SECOND PRIZE, 2*l.*

336 ABBOTT BROTHERS, Thuxton, Hingham, Norfolk: THIRD PRIZE, 1*l.*

337 WILLIAM BARNES, Moorhouse Mill, Wigton, Cumberland: the *Reserve Number* and *Highly Commended.*

Class 49.—*Any other colour Cock and One Hen.* [1 entry.]

No Award.

COMPETITION OF BUTTER-MAKERS.

Class 1.—*Members of a Farmer's Family.* [8 entries.]

3 MRS. HOLMES, Home Farm, Leigh, Tunbridge Wells: FIRST PRIZE, 5*l.*

8 MRS. STEVENSON, Rossburn House, Shincliffe, Durham: SECOND PRIZE, 3*l.*

1 MISS AMY BARRON, Borowfield House, Borrowash, Derby: THIRD PRIZE, 2*l.*

4 MRS. HUTCHINSON, Lockington Grange, Hull, Yorkshire: the *Reserve Number* and *Highly Commended.*

Nos. 2 and 7 were *Highly Commended.*

Class 2.—*Male Hired Servants.* [3 entries.]

9 JAMES WALKER, Portmahon Farm, Everton, Sandy, Bedfordshire: FIRST PRIZE, 5*l.*

10 THOMAS SMITH, Barrowmore Farm, Chester: SECOND PRIZE, 3*l.*

11 THOMAS KEW, 15 Market Place, Leicester: THIRD PRIZE, 1*l.*

Class 3.—*Female Hired Servants.* [3 entries.]

14 MISS FRANCES M. WALSHE, Woodhouse, Aldford, Chester: FIRST PRIZE, 5*l.*

13 MRS. WALKER, Portmahon Farm, Everton, Sandy: SECOND PRIZE, 2*l.*

12 MISS ALICE ALDRIDGE, 9 Market Place, South, Leicester: THIRD PRIZE, 1*l.*

Class 4.—*Champion, limited to Winners of Prizes in the preceding Classes.*

3 Mrs. Holmes: Silver Medal.
13 Mrs. Walker: Bronze Medal.
9 James Walker: Bronze Medal.

COMPETITION OF SHOEING-SMITHS.

Limited to the Counties of Derby, Leicester, Lincoln, Northampton, Nottingham, and Rutland.

Class 1.—*Hunters.*

32 Samuel Palfre, Sadler Gate, Derby: First Prize, 6*l.*[1]

38 Thomas Sewell, High Street, Bracebridge, Lincoln: Second Prize, 4*l.*[2]

20 George Green, London Road, Weedon, Northampton: Third Prize, 3*l.*

24 John Hutton, Scamblesby, Horncastle, Lincoln: Fourth Prize, 2*l.*[2]

30 William B. Milner, Jun., Kirklington, Southwell, Notts: Fifth Prize, 1*l.*

37 Herbert Benjamin Sewell, Chaplin Street, Lincoln: the *Reserve Number* and *Very Highly Commended.*

29 Thomas Mettam, Wharf House, Sleaford, Lincolnshire: was *Commended.*

Class 2.—*Agricultural Horses.*

59 Frederick Clay, King Street, Alfreton, Derbyshire: First Prize, 6*l.*[1]

83 George Rhoades, Chaplin Street, Lincoln: Second Prize, 4*l.*[2]

70 William Holt Green, Flore, Weedon, Northampton: Third Prize, 3*l.*

84 Herbert Benjamin Sewell, Lincoln: Fourth Prize, 2*l.*[2]

68 George Green, London Road, Weedon, Northampton: Fifth Prize, 1*l.*

77 Arthur King, 24 Oxford Street, Market Rasen, Lincolnshire: the *Reserve Number* and *Very Highly Commended.*

52 Christopher Bett, High Street, Bracebridge, Lincolnshire: was *Very Highly Commended.*

85 Thomas Sewell, High Street, Bracebridge, Lincolnshire: was *Very Highly Commended.*

93 William Woodward, West Keal, Spilsby, Lincolnshire: was *Highly Commended.*

75 William Stevenson Johnson, Guilsborough, Northamptonshire: was *Highly Commended.*

79 Thomas Mettam, Wharf House, Sleaford, Lincolnshire: was *Highly Commended.*

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[1] To these men, being the winners of the First Prizes in each Class, the Worshipful Company of Farriers have granted, free of cost, the freedom of the Company.

[2] These men, being shoeing-smiths residing in the County of Lincoln, also received from the Lincolnshire Agricultural Society gratuities amounting to half the amount of the prizes awarded to them by the Royal Agricultural Society.

IMPLEMENTS.

Class 1.—*Hay and Straw Presses, worked by Steam Power.*

3815 John H. Ladd & Co. 116 Queen Victoria Street, London, E.C.: First Prize, 30*l.*

2299 Samuelson & Co., Limited, Banbury, Oxfordshire: Second Prize, 20*l.*

Class 2.—*Hay and Straw Presses, worked by Horse Power.*

3819 George Stephenson, Newark-on-Trent, Notts.: First Prize, 20*l.*

3815 John H. Ladd & Co., 116 Queen Victoria Street, London, E.C.: Second Prize, 10*l.*

Class 3.—*Hay and Straw Presses, worked by Hand Power.*

557 Joseph Bamber, Saul Street, Preston, Lancashire: First Prize, 20*l.*

3806 William Warnes, Kings Lynn, Norfolk: Second Prize, 10*l.*

Class 4.—*For a Press for Old Hay, worked by Hand Power.*

557 Joseph Bamber, Saul Street, Preston: Prize, 20*l.*

2263 Barford & Perkins, Peterborough: *Highly Commended.*

Silver Medals.

3603 Priestman Brothers, Holderness Foundry, Hull, for Petroleum Engine, 4 horse-power.

3885 Whitmore & Binyon, Wickham Market, Suffolk, for Middlings Purifier, Weis' Patent.

917 Thyss, Lockyer & Co., 374 Euston Road, London, N.W.: for Jersey Creamer.

FARM PRIZES.

Given by the Nottingham Local Committee.

Class 1.—*For the best managed Arable and Grass Farm, of* 300 *acres and upwards, of which not less than one-half shall be arable.*

11 Samuel C. Machin, Forest Farm, Papplewick, Nottingham: First Prize, 100 guineas.

12 William Machin, Papplewick, Nottingham: Second Prize, 50 guineas.

Nos. 1, 2, 3, and 8 were *Highly Commended.*

Nos. 4, 5, 7, 10 and 14 were *Commended.*

Class 2.—*For the best managed Arable and Grass Farm, above* 100 *acres and not exceeding* 300 *acres, of which not less than one-half shall be arable.*

26 W. E. Wadsley, Dunsby, Bourne, Lincolnshire: First Prize, 50 guineas.

19 William Cave, Baston, Market Deeping, Lincolnshire: Second Prize, 25 guineas.

No. 21 was *Highly Commended.*

Nos. 18 and 24 were *Commended.*

Class 3.—*The best managed Arable and Grass Farm, above* 25 *acres and not exceeding* 100 *acres.*

33 R. Shelton, Grange Farm, Ruddington, Notts: First Prize, 50 guineas.

27 John Baguley, East Bridgford, Bingham, Notts:
35 James Widdowson, Hucknall Torkard, Notts:
} Second Prize, 25 guineas, equally divided.

Nos. 29 and 31 were *Highly Commended.*

Gratuities to Farm Servants.

The Council have, upon the recommendation of the Judges of Farms, awarded certificates of distinguished merit in the discharge of their duties, together with Money Gratuities, to the following servants on the competing farms.

Charles Chapman, Leadenham, Grantham. Recommended by Mr. R. W. Morley, for good and faithful service as bailiff for 21 years.

Thomas Clay, Temple Bruer, Grantham. Recommended by Mr. Robert G. F. Howard, for 27 years' service as shepherd. Specially mentioned as an excellent servant in every way, as well as most efficient at his own work.

Thomas Coulson, Baston, Market Deeping. Recommended by Mr. W. Cave, for 36 years' service. Specially mentioned as an excellent man with cattle and general farm work.

Thomas Green, Dunsby, Bourne. Recommended by Mr. W. E. Wadsley, for 36 years' service with his father and himself. Specially mentioned for general knowledge of stock, as having been awarded a prize for raising the largest number of lambs.

John Haddon, Baston. Recommended by Mr. Cave, for 22 years' service. Specially mentioned for hedging, thatching, and draining.

William Hammond, Tydd Saint Mary, Wisbech. Recommended by Mr. H. A. Kilham, for 28½ years' service with his father and himself. Specially mentioned for general knowledge in the management of breeding stock.

Joseph Hardwick, Woodthorpe. Recommended by Mr. T. Bower, for 27 years' service on the farm now held by Mr. Bower. Specially mentioned as being an excellent man with stock, and as having a general knowledge of all kinds of agricultural work.

George Hayward, Temple Bruer, Grantham. Recommended by Mr. Robert G. F. Howard, for 25 years' service as a yardman. Specially mentioned as a good feeder of beasts.

John Hopkins, Dunsby, Bourne. Recommended by Mr. W. E. Wadsley, for 26 years' service. Specially mentioned for excellence in draining, thatching, and hedging.

Henry Tideswell, Hucknall Torkard. Recommended by Mr. James Widdowson, for 23 years' service as a good and faithful servant. Specially mentioned as an excellent man with stock, as well as drilling, thatching, and stacking.

Robert Wyles, Baston, Lincolnshire. Recommended by Mr. W. Cave, for 27 years' service with his father and himself, as a good and excellent horseman.

AGRICULTURAL EDUCATION.

Papers set at Senior Examination, May, 1888.*

EXAMINATION IN AGRICULTURE.

Maximum Number of Marks for this Paper, 200. Pass Number, 100.

Tuesday, May 8th, from 2 p.m. till 5 p.m.

1. In the selection of a farm for profitable occupation, what considerations would influence you in making your choice?

2. What indications of natural fertility or poverty of the soil would you look for?

3. What are the systems of crop rotation best known and most generally followed; and to what circumstances are they respectively adapted?

4. What modifications of the four-course system have been of late introduced, and what are the conditions which have occasioned such modifications?

5. What are the general principles which underlie all systems of crop rotation?

6. Give the names of the principal corn, green, and forage crops grown in England, with particulars as to—

(1) The ordinary season of sowing.
(2) The quantity of seed usually sown per acre.
(3) The crop ordinarily produced per acre under good management on land suitable to the crop.
(4) The soils most favourable for their growth.

7. Give the names of the more valuable grasses and clovers for laying down land for—

(*a*) Permanent pasture.
(*b*) Seeds for one year's hay.
(*c*) Seeds for two or three years' ley.

* For the new Regulations for the Senior Examinations, see page cxxxix.

8 Give particulars of a mixture for any one of these purposes on a rich loamy soil.

9. How would you judge whether a crop of meadow hay or a crop of red clover was fit for mowing ?

10. At what distance apart would you drill wheat, beans, swedes, mangolds ?

11. What is a fair day's work on land neither light nor heavy for—

A pair-horse team ploughing.
Three horses rolling, roll 7 ft. wide.
Drilling corn, drill 6 ft. 6 in. wide.
Three men filling manure from a dung-heap.

12. What are the most common weeds which are troublesome and injurious to the farmer ; and what are the means usually taken to eradicate or subdue them ?

13. Give the names of the more important distinct breeds and of the most successful cross-breeds of cattle and sheep in Great Britain, and give some notes as to the localities and situations to which certain breeds are best adapted.

14. Among sheep, specify some long-woolled and short-woolled breeds.

15. What are the average periods of gestation for the following:
The mare.
The cow.
The ewe.
The sow.

16. What is meant by a full-mouthed ewe ?

17. What breeds of cattle are most suitable for dairy purposes ?

18. At what age are heifers ordinarily put to the bull ?

19. What is a good average yield of milk from a dairy cow *per diem* for nine months after calving ?

20. Suggest a dietary for cows in full milk in winter, assuming your own conditions as to supply of natural or artificial food.

21. What are the most striking improvements in the general practice of agriculture in England during the last fifty years ?

Vivâ Voce Examination in Agriculture.

Wednesday Afternoon, May 9.

Maximum Number of Marks, 100. Pass Number, 50.

EXAMINATION IN BOOK-KEEPING.

MAXIMUM NUMBER OF MARKS, 200. PASS NUMBER, 100.

Wednesday, May 9th, from 10 *a.m. till* 1 *p.m.*

A farmer begins the year with 50*l.* cash, and a stock valued at 1,000*l.*, clear of all liabilities, and during the year makes purchases, of which the following is a summary :—

	£	s.	d.
Live stock	500	0	0
Cake	150	0	0
Hay and straw	10	0	0
Horse corn, &c.	25	0	0
Seeds and seed corn	35	0	0
Implements	10	0	0
Manure	50	0	0
Sundries	30	0	0

having paid cash by the end of the year for all the above, with the exception of 50*l.* still owing for cake, and 10*l.* for sundries. His rent for the year amounts to 240*l.*, of which 60*l.* is still owing at its close ; and he has paid in cash the following expenses :—

	£	s.	d.
Rates, taxes, and insurance . . .	28	0	0
Labourers' wages	180	0	0
Incidentals	50	0	0
Own private expenses	167	0	0

His receipts for the year are as follow :—

	£	s.	d.
Corn	230	0	0
Live stock	1,200	0	0
Wool	30	0	0
Dairy produce	30	0	0
Hay and straw	15	0	0
Keeping	20	0	0
Poultry and sundries	30	0	0

His stock at the end of the year is valued at 950*l.*, and he has 250*l.* in cash.

Draw up abstract account showing Profit or Loss on the year's transactions.

Make out short statement showing amount of assets and liabilities and balance of capital at beginning and end of the year.

EXAMINATION IN CHEMISTRY.

MAXIMUM NUMBER OF MARKS, 200. PASS NUMBER, 100.

A. GENERAL CHEMISTRY.

Thursday, May 10th, from 10 a.m. till 1 p.m.

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1. Give an account of the properties of carbon and charcoal.

2. What are the chief substances in solution in sea-water, common spring-water, and rain-water, respectively? How is water from a pond affected by filtering it through a bed of sand?

3. How may nitrates be made to yield ammonia? Calculate the weight of ammonia which 1000 grs. of sodium nitrate will yield. ($Na = 23$, $N = 14$.)

4. Describe the chemical characters of silica and silicic acid. What silicates are soluble in water, and how may they be distinguished from salts of other acids?

5. In what substances and in what states of combination does sulphur most commonly occur in nature? How can sulphites, such as sodium and calcium sulphite, be prepared? How do you explain the antiseptic property of sulphites?

6. State the composition, general properties, and mode of preparation, of caustic potash. Explain its action with copper sulphate and ferric chloride respectively.

7. Explain the chemical nature and distinctive properties of copperas, red lead, alumina, pyroligneous acid, paraffin.

8. State the composition of urea, and explain why it is said to be carbamide. What chemical changes does it most readily undergo? How can it be made artificially?

9. What are the chemical relations between cane and grape sugar? What conditions are requisite for the transformation of sugar into alcohol? How can absolute alcohol be obtained?

B. Agricultural Chemistry.

Thursday, May 10th, from 2 p.m. to 5 p.m.

1. Illustrate by examples differences of root-range exhibited by crops, especially with regard to the constituents they are capable of taking up from the soil and from manures, and to their place in a rotation.

2. What are possible causes of "clover sickness"? Give brief accounts of any investigations bearing on the subject.

3. Name any special functions which the presence of the following constituents in soils is held to perform:—Oxide of Iron; Alumina; Chlorine; Sulphur; Magnesia; Soda; Silica.

4. In what form or forms does Sugar exist in Swedes and in Mangels, and in what respective quantities on an average? How would you determine the amounts analytically?

5. Compare oxen, sheep, and pigs in respect of relative increase of live weight to food consumed. What are the chief differences of composition shown by the excrements in either case?

6. Describe the chemical nature and methods of preparation of the following:—Creosote; Malt; Margarine; Basic Cinder.

7. Describe special uses in agriculture of these materials:—Seaweed; Shoddy; Salicylic Acid; Boracic Acid; Shell-sand; Sawdust; Gypsum; Gas Lime; Liquid Manure; Peat.

EXAMINATION IN MENSURATION AND LAND SURVEYING.

Maximum Number of Marks, 100. Pass Number, 50.

Friday, May 11th, from 2 p.m. till 5 p.m.

1. The side B C of a triangle A B C is 12·37 chains long; the perpendicular from A to B C meets B C in N, where B N, N C are 8·41 and 3·96 chains in length; the length of A N is 11·08 chains. Draw the triangle to a scale of 5 chains to an inch; note the lengths of A B and A C and the number of degrees in the angles; and find the area of the triangle in acres, roods, and perches.

2. An ingot of steel is 3 ft. long, and has a square cross-section whose side is 10 in.; find its weight, having given that the specific gravity of steel is 7·8. If the ingot were formed into a rail 30 ft. long, what would be the area of the cross-section of the rail?

3. The diameter of the funnel of a rain-gauge is 4·7 in.; what quantity of water collected by the funnel would indicate a rain-fall of one-tenth of an inch ?

4. A heap of gravel is made in the usual way on level ground ; its base is 40 ft. long by 30 ft. wide ; its height is 4 ft.; the slope of the sides is 4 vertical to 5 horizontal ; how many cubic yards of gravel are there in the heap ?

5. If a map were drawn to a scale of 25 in. to a mile, what number of square yards on the ground would be represented by a square inch on the map ? But if the representative fraction of the scale were $\frac{1}{2500}$, what number of square yards would now be represented by a square inch ?

6. On opposite sides of a stream, whose general direction is from west to east, points A and B are taken 1·64 apart ; on the south side, at right angles to A B, points A, C, D are taken in a straight line, A C = 12·55, C D = 5·27 ; a point E is taken north of C D, such that C E = 6·14, D E = 4·64. The south side runs nearly along A C, C E as shown in No. 1. On the north side of the stream a point F is fixed by the angles F C D = 62°, F D C = 72° ; the north side is then determined by No. 2.

All the distances are in chains.

Draw a plan of this portion of the stream, on a scale of one inch to two chains.

No. 1.

	E
0·20	6·14
	C
0·55	12·55
0·47	6·14
0·35	2·05
0·00	0·00
	A

7. After having drawn the plan in *Q.* 6, state any other way that occurs to you of laying down a plan of that portion of the stream, and mention briefly the advantages of the method you propose.

8. Points A, B, &c., are taken along a road, the horizontal distances in chains being as follows :— A B = 6·6, B C = 14·4, C D = D E = 5, E F = 7·6 ; the heights in feet of the points A, B, &c., above the datum line are 95·8, 86·4, 68·7, 67·0, 70·8, 85·2. Draw a section of the road, distances to a scale of 1 in. equal to 4 chains, heights 1 in. equal to 10 ft.

If the level is placed between A and B, and the staff held at A reads 2·67 ; what will it read when held at B ?

No. 2.

F	
16·36	0·14
14·73	0·95
12·36	1·77
8·04	1·23
3·55	0·41
0·00	0·00
B	

9. A B C is a triangle, A B = 86·15 chains, A C = 61·45 chains ; B bears 21° 20′ S. of W. from A, C bears 43° 18′ N of W. from A ; find, both by construction and calculation, the area of the triangle A B C, and the bearing of C from B.

EXAMINATION IN MECHANICS AND NATURAL PHILOSOPHY.

MAXIMUM NUMBER OF MARKS, 200. PASS NUMBER, 100.
Friday, May 11*th, from* 10 *a.m. till* 1 *p.m.*

1. Define the centre of gravity of a body. Mention any one case in which the centre of gravity is not a point of the body itself.

Why is it difficult (or impossible) to balance a rod horizontally on your finger? Why is the difficulty diminished (or removed) when a weight is hung from each end of the rod?

2. A thread, which hangs over a fixed pulley, carries a body at each end; why will the bodies remain at rest if their weights are equal? What frictions are there in this case tending to keep the bodies at rest even when the weights are unequal?

3. Show in a diagram how to combine a fixed and a movable pulley into a system for raising a weight. If it is found by trial that when either pulley is fixed (as in *Q.* 2) a weight of 500 lbs. is required to lift off the ground a weight of 460 lbs., what force would be required to lift a weight of 1,000 lbs. off the ground, when the system shown in your answer to the first part of the question is used?

4. When a heavy body, such as the trunk of a tree, is moved forward on rollers, how much faster than the rollers does the body tend to advance, and why?

5. Define a foot-pound and a horse-power.

It is found that by a consumption of 1,200 lbs. of coals a train of 60 tons can be made to move over 40 miles against a resistance of 7 lbs. a ton; how many foot-pounds of work are got out of each bushel (84 lbs.) of coals consumed?

6. A body weighing 10 tons is moving at the rate of 30 miles an hour: how many foot-pounds of work is it able to do against a resistance? If the resistance were a constant friction of 8 lbs. a ton, how far would the body move before being brought to rest? ($g=32$).

7. Describe the method of finding the specific gravity of a liquid by a specific gravity bottle.

If the bottle when full of water is counterpoised by 988 grains and the counterpoise of the empty bottle, and when full of sulphuric acid by 1,742 grains and the counterpoise, what is the specific gravity of the sulphuric acid?

State briefly how the result would be affected by the buoyancy of the atmosphere.

8. Write down the formula which expresses the relation between the volume, pressure, and temperature of a given quantity of gas, stating exactly the meaning of each letter which enters the formula.

The volume of a certain quantity of gas is 2,000 cubic inches, when under a pressure of 29·325 inches of mercury, and when the temperature is 68° F. (20° C.); at what temperature would its volume be 2,500 cubic inches, under a pressure of 26·715 inches of mercury? (Temperature of mercury the same in both cases.)

9. Define a unit of heat and its mechanical equivalent.

When a steam-engine lifts a weight of one ton to a height of 386 feet, how many units of heat are consumed in doing this work?

To what temperature would that number of units of heat raise 10 gallons of ice-cold water.

EXAMINATION IN BOTANY.

MAXIMUM NUMBER OF MARKS, 100. PASS NUMBER, 50.
Saturday, May 12th, from 10 a.m. to 1 p.m.

1. How would you distinguish a plant from an animal in their simplest forms?

2. Describe the methods of multiplication of the vegetable cell.

3. What is, *a*, protoplasm; *b*, chlorophyll; *c*, cellulose; and *d*, starch?

4. Describe the structure of the leaf, and explain its function.

5. What are the principal elements of the food of plants; where are they obtained; and by what organs are they appropriated?

6. What are the external conditions necessary for the germination of a seed?

7. What is the structure of a grain of wheat? Compare it with the structure of a pea.

8. Describe the organs of reproductiom in the Gymnosperms; explain how the ovule is fertilised; and give the names of the gymnosperms which are natives of Britain.

9. Give a sketch of the life history of the fungus that causes mildew in wheat.

10. Name three insectivorous plants; describe the methods by which they seize their prey; and explain how the insects are utilised by the plants.

11. State the principal characters of the Gramineæ, Leguminosæ, and Cruciferæ.

12. Name and describe the plants A, B, and C, taking the organs, if present, in the following order: root, stem, leaves, bracts, sepals, petals, stamens, pistil, fruit, and seeds.

EXAMINATION IN GEOLOGY.

MAXIMUM NUMBER OF MARKS, 100. PASS NUMBER, 50.
Tuesday, May 8th, from 10 *a.m. till* 1 *p.m.*

1. Enumerate some of the different kinds of Soils. Of what are they composed? How did they originate? Where are they, respectively, met with? What is their relative agricultural value?

2. Write an account of the origin and mode of occurrence of Natural Springs; and state under what conditions water may be expected to be found in common Wells and artesian Borings. Give diagrams in your answer.

3. Of what great classes of Rocks is the Crust of the Earth chiefly composed? State the nature and origin of each class; and refer to British or other localities for examples of each.

4. Draw a Section across any district, shewing how the *form of ground* is dependent upon *geological structure*. Describe the details of the Section.

5. Show how attention to the *dip* of strata will often save expense both in the first construction and in the future maintenance of a *road* carried along a hill-side, through a country composed of stratified rocks.

6. Which are the best kinds of stone to be used for *road-metal*? Give your reasons for the selection; and state where these materials are most likely to be found.

7. Give some account of the different kinds of *coal*, *lignite*, and *peat*; noticing their composition, external characters, origin, localities, and uses.

8. Under the several headings of *crystalline*, *massive*, *bedded*, *schistose*, and *cleaved*, tabulate the best known of the different kinds of Rocks; and give some notes on their respective *origin* and the *changes* they have undergone.

9. On the accompanying outline map of the British Islands indicate the distribution, range, and extent of the Carboniferous System, in its several great stratigraphical groups or Formations.

10. Make a Table of *either* the Secondary *or* the Tertiary strata of England. Explain the *meaning* and *scientific value* of the *names* you use; give notes on the *range* of the several *formations* you mention, and enumerate some of their chief fossils.

11. Give diagrams and descriptions of the geological structure of *either* Snowdon and the Malvern Hills, *or* Arthur's Seat and the Cotteswolds.

12. Describe the Specimens on the Table.

EXAMINATION IN ANATOMY AND ANIMAL PHYSIOLOGY.

Maximum Number of Marks, 100. Pass Number, 50.
Saturday, May 12th, from 2 p.m. till 4 p.m.

1. Given that the movement of the lower jaw of the Ox in masticating the food differs from that of many other animals, name an animal from which it most differs, and state the advantages connected therewith.

2. Describe the action of the saliva on the food, and name the principal glands which secrete the fluid, and the parts of the mouth where their ducts open.

3. Name the stomach into which the food first enters in ruminating animals, and describe its function in facilitating digestion. State also the names and functions of the other stomachs, particularising the one in which digestion is completed.

4. Name the chief muscles which assist in the inspiration and expiration of air in breathing, and say in what essential particulars expired air differs from inspired.

5. Give the number, names, and relative position of the muscles attached to the eyeball of the Horse, naming those which in the several movements of the eyes act simultaneously and in pairs, and which do not.

6. Describe the position and general structure of the kidneys, and name the chief difference in their size and form, comparing those of the Ox with the Sheep. State also the course which the urine takes to be expelled from the body.

7. Give the period of utero-gestation in the several animals of the farm.

8. Describe the so-called natural position of a fœtus at the time of parturition, and say in which animal, the Mare or Cow, labour is the soonest completed. State also the average time it occupies in each of these animals.

9. Give the names of the several membranes which envelope the fœtus *in utero*, and name the difference which exists in the attachment of the outermost-placed one to the inner surface of the uterus in the Mare and Cow.

REGULATIONS AS TO SENIOR PRIZES AND CERTIFICATES.

[*The following New Regulations for these Prizes and Certificates were approved by the Council on June* 27, 1888, *and will come into force for the examination to be held in May* 1889.]

1. An Examination of Candidates for the Society's Senior Prizes and Certificates is held annually in the month of May at the Society's House, 12, Hanover Square, London, W. The next Examination will take place in the week commencing May 6, 1889.

2. Forms of entry may be obtained of the Secretary, and must be returned to him duly filled up on or before March 31 preceding the Examination.

3. A Deposit of 1*l.* must be paid by each candidate at the time of making his entry. This Deposit will be returned to all candidates attending for examination at the proper time, but will in other cases be forfeited, unless an explanation satisfactory to the Council be received before the first day of the examination.

4. The examinations will be conducted by means of written papers, and by a *vivâ voce* examination.

5. The successful candidates will be placed in two classes, and arranged in order of merit.

6. Certificates, to be termed first- and second-class certificates, will be granted to candidates placed in the first and second class: such certificates will specify the subjects in which the candidates shall have satisfied the Examiners.

7. In order to obtain a *first-class* certificate, a candidate must satisfy the Examiners in the Practice of Agriculture, Book-keeping, Chemistry, Land Surveying, and Agricultural Engineering.

8. Each candidate obtaining a first-class certificate will thereby become a Life Member of the Society.

9. The following prizes will be awarded to candidates placed in the first class for aggregate merit:—First Prize, 25*l.*; Second Prize, 15*l.*; Third Prize, 10*l.*; Fourth Prize, 5*l.*

10. In order to obtain a *second-class* certificate, a candidate must satisfy the Examiners in the Practice of Agriculture, and also in three of the four following subjects, all of which must be *bonâ fide* attempted :—Book-keeping, Chemistry, Land Surveying, and Agricultural Engineering.

11. A candidate may offer himself for examination in one or more of the following subjects, viz. :—Botany, Geology, and Anatomy. Any knowledge which he may show of these subjects will be counted to his credit in the general classification, provided that he shall have fulfilled the foregoing conditions, and provided that the knowledge of these *optional* subjects does not fall below the standard fixed as a minimum in each of such subjects.

12. A candidate who does not obtain half the maximum number of marks in any of the subjects in which he is examined will be considered as failing in that subject. The maximum number of marks obtainable in each subject is as follows :—

Agriculture	200	Land Surveying	200
,, *vivâ voce* examination	100	Agricultural Engineering	200
Book-keeping	200	Botany	100
Chemistry	200	Geology	100
		Anatomy	100

By Order of the Council,

ERNEST CLARKE, *Secretary.*

12, Hanover Square, London, W.
June 27, 1888.

SYLLABUS OF SUBJECTS FOR THE SENIOR EXAMINATION.

I. PRACTICAL AGRICULTURE.

II. BOOK-KEEPING.

To exhibit, by working out in proper technical form, a given series of imaginary transactions, a knowledge of the use of the "Cash Book" and the "Journal," and the preparation of a Profit and Loss Account, and Balance-sheet, as the result of such imaginary transactions.

III. GENERAL CHEMISTRY.

Definition and classification of elements. Occurrence in nature and leading characters of the elements most commonly met with. Preparation and properties of common products of inorganic chemistry (such as the mineral acids, alkalies, salts, &c.). The Laws of chemical combination. Explanation of equivalence and quantivalence. Distinction of chemical and mechanical compounds. Laws of gaseous diffusion. The atmosphere. Theory of combustion. Qualitative and quantitative analysis of atmospheric air. Qualitative analysis of common inorganic substances. Quantitative analysis in simple cases (such as the determination of strength of solutions, proportions of acids and bases in simple salts) by volumetric and gravimetric methods. Ultimate organic analysis by combustion. Proximate analysis by solvents; dialysis and fractional distillation. Definition of compound radicles. The chemical characters of cyanogen and its most common compounds, urea, and uric acid. Saccharine and amylaceous compounds. Fermentation. Ordinary alcohol and ether, and the most common compound ethylic ethers. Oxalic acid, lactic acid, acetic acid and its homologues, fats, glycerine, and soap. Paraffin. Phenol. Turpentine and resin. Tannin. Albumen. Gelatine.

N.B.—In this section exact knowledge of general principles and typical compounds is expected, rather than diffuse information.

IV. AGRICULTURAL CHEMISTRY.

Chemical composition and analysis of soils. Chemical properties of soils. Physical properties of soils. Chemical and other effects of ploughing, subsoiling, and draining. Paring and burning. The use of lime, marl, and shell-sand in Agriculture. Means of improving the soil by the use of Manures. Vegetable Manures. Animal Manures. Farm-yard Manure. Liquid Manure. Sewage of Towns. Night-soil. Artificial Manures. Guano. Composition of Peruvian guanos and phosphatic guanos. Adulteration of guano and the means of detecting it.

The various forms in which bones are used in Agriculture. Superphosphate of lime; composition, value of different samples, analysis and determination of their commercial value. Nitrate of soda, common salt, sulphate of ammonia, soot, &c. Chemical phenomena of germination; functions of leaves and roots. Forms in which the organic elements, carbon, hydrogen, oxygen, nitrogen, sulphur, and phosphorus enter into plants.

The inorganic constituents of plants; potash, soda, lime, phosphoric acid, &c. Composition of the ashes of plants.

Spring-water, River-water, and Sea-water. Properties of good and bad drinking waters. Irrigation.

The properties and composition of milk, cream, butter, and cheese.

Composition and nutritive value of different kinds of food grown on the Farm. Practical and commercial value of different kinds of oil-cake. Manurial value of different kinds of food.

V. MENSURATION AND LAND SURVEYING.

Ordinary rules of superficial and solid mensuration. Volume of a prismoid. Applications to practical questions. Estimation of weights of bodies whose dimensions and specific gravity are known.

Land surveying by chain. Plotting from field book, and determination of areas surveyed. The simpler "ground problems."

Levelling and plotting from field book.

Trigonometrical surveying, and determination of heights and distances by Theodolite; as essential to this, solution of plain triangles by the aid of Logarithmic Tables.

VI. AGRICULTURAL ENGINEERING.

a. Mechanics.

Centre of gravity; stability of structures. The lever; toothed wheels; pulleys and ropes; wrapping connectors; winches; differential pulleys. Laws of motion. Strength of materials, tensile, compressive, torsional, and transverse; elastic limit; ultimate strength. Work; horse-power; animal and human power. Friction of surfaces and axles; lubrication.

b. Heat.

Nature of heat; thermometer; absolute zero; specific heat; latent heat; the unit of heat. Total heat of water; as ice, water, and steam. Conduction, convection, and radiation of heat. Mechanical equivalent of heat. Principle of combustion. Quantity of heat generated by combustion. Modes of transforming heat of combustion into power.

c. Air.

Composition of air. Properties of air; elasticity, specific heat. Barometer; moisture; movement. Winds. Windmills. Office of air in combustion; quantity required.

d. Water.

Composition. Weight. Height of column to balance atmosphere. Flow of water. Friction of water in pipes and channels. Usual speeds of flow. Power derived from falls of water. Water-wheels; turbines; water-pressure engines; pumps. Potable water. Sources of supply. Means of purification. Storage.

e. Steam Engine.

Construction of an ordinary portable-engine boiler, of a Cornish boiler and its setting. Fittings of a boiler. Construction of the stationary and portable steam-engine. Single cylinder. Double cylinder. Compound. Slide-valve. Expansion valve. Cylinder. Piston-rod. Glands. Connecting-rod. Crank and crank shaft. Fly-wheel. Bearings. Pet cocks. Lubrication. Steam and fuel consumed per horse-power.

f. Gas and Petroleum Engines.

Principle of action. Construction of valve-gear. Sources of loss. Fuel and water required per horse-power.

g. Agricultural Implements.

On the mode of action and the general principles involved in the construction of farm implements. The adjustments of implements for different descriptions of work. Lubrication. Working or wearing parts.

1. Cultivating Implements actuated by Steam Power.

2. Horse-cultivating Implements.—Ploughs of various kinds. Cultivators or Grubbers. Harrows. Rollers. Scrubbers.

3. Sowing Implements.—Drills. Manure and water drills. Broadcast barrows. Broadcasters. Manure distributors. Potato Planters.

4. Hoeing Implements.—Horse-hoes. Scufflers.

5. Implements employed in securing Crops.—Reaping machines of all kinds. Mowing machines. Hay-makers. Horse-rakes. Elevators. Potato-raisers.

6. Carriages.—Carts and waggons.

7. Implements for preparing Crops for Market.—Thrashing machines. Winnowing machines. Corn screens. Hummellers. Hay and Straw Presses.

8. Implements for preparing Crops for Home Consumption.—Mills. Chaff-cutters. Pulpers. Turnip-cutters. Cake-breakers. Cooking apparatus.

9. Dairy Implements.—Cream separators. Churns. Butter workers. Cheese tubs. Curd mills. Setting-pans. Refrigerators.

10. Implements and Appliances used in Land Improvement.—Drainage instruments. Lime-kilns. Arrangements of shafting, pulleys, clutches &c., for farm machinery at homesteads.

11. Silage Appliances.

Students must be prepared to point out the various adjustments, working parts, merits, faults, and uses of the above-named implements. They must also be prepared to answer questions upon the character and quality of the work done, as well as upon the construction of the implements themselves.

*** *Questions will be set upon all parts of the above syllabus of Agricultural Engineering, but it is not contemplated that a candidate shall answer more than half the questions put. Formal proofs of theorems will not be required, and credit will be given for practical knowledge shown.*

VII. BOTANY.

The structure of plants.
The organs of plants and their functions.
The life of plants.
The diseases of plants.
The chemical composition of plants.
The function of manures.
The useful, useless, and injurious plants of Agriculture.
The classification of plants.

N.B.—Candidates are required to identify three plants, and to describe them in a scientific manner.

VIII. GEOLOGY.

Nature and objects of Geological Science.
Chief minerals entering into the composition of rocks.
Origin and composition of rocks.
General principles of the classification of rocks.
Subdivisions of the stratified rocks, and their geographical distribution in the British Islands.
Geological distribution of Fossils.
Characteristic Fossils of the Chief Formations.
The different kinds of soils, their origin and formation.
Relation of Strata to water supply and drainage.
Origin of springs.
The various mineral manures, their characters and mode of occurrence.
The weathering and disintegration of rocks.
Permeable and impermeable rocks.
Different kinds of building stones and road materials.
Distribution of the various economical substances.

N.B.—Candidates will be required to give the names of rocks, minerals, and fossils.

IX. ANATOMY AND ANIMAL PHYSIOLOGY.

Classification of the animal kingdom as applied to Domesticated Animals.

Comparative osteology of the animals of the farm, inclusive of the arrangement of the bones in the formation of the skeleton.

Composition, structure, and use of bone, cartilage, ligament, and tendon. The formation and classification of joints.

Structure and function of muscle, voluntary and involuntary.

General anatomy of the brain and nervous system. Voluntary and involuntary motion.

Structure and functions of the circulatory organs in Mammals. Heart, arteries, capillaries, veins.

Composition and properties of the blood, chyle, and lymph.

Structure and function of the several organs of respiration. Animal heat. Normal and abnormal temperature.

General structure of the reproductive organs—male and female.

Impregnation, pregnancy, and parturition of domesticated animals.

Leading peculiarities in the digestive organs of the different classes of animals.

Development and structure of teeth. Dentition as indicating the age of animals of the farm.

Appropriation of food and water by the processes of digestion, assimilation, absorption, and nutrition. Secretory and excretory organs.

Disposal of excess of nutritive matter; waste of body, how effected and how repaired.

Structure and functions of the integumental parts of the body. Skin, mucous membrane, and horny substance.

Structure and functions of the organs of sight and hearing.

N.B.—The knowledge of Anatomical facts and Physiological principles required of candidates in this section is not more than may be acquired by the thorough mastery of elementary treatises which include the subjects above prescribed.

MEMORANDA.

ADDRESS OF LETTERS.—The Society's office being situated in the postal district designated by the letter **W.**, Members, in their correspondence with the Secretary, are requested to subjoin that letter to the usual address.

GENERAL MEETING in London, Thursday, December 13, 1888, at noon.

GENERAL MEETING in London, Wednesday, May 22, 1889, at noon.

COUNTRY MEETING in Windsor Great Park, week commencing June 24, 1889.

MONTHLY COUNCIL (for transaction of business), at noon on the first Wednesday in every month, excepting January, September, and October: open only to Members of Council and Governors of the Society.

ADJOURNMENTS.—The Council adjourn over Passion and Easter weeks, when those weeks do not include the first Wednesday of the month; from the first Wednesday in August to the first Wednesday in November; and from the first Wednesday in December to the first Wednesday in February.

OFFICE HOURS.—10 to 4. On Saturdays 10 to 2.

DISEASES of Cattle, Sheep, and Pigs.—Members have the privilege of applying to the Veterinary Committee of the Society, and of sending animals to the Royal Veterinary College, Camden Town, N.W.—(A statement of these privileges will be found on page cxlix. in this Appendix.)

CHEMICAL ANALYSIS.—The privileges of Chemical Analysis enjoyed by Members of the Society will be found stated in this Appendix (page cxlvi.).

BOTANICAL AND ENTOMOLOGICAL PRIVILEGES.—The Botanical and Entomological Privileges enjoyed by Members of the Society will be found stated in this Appendix (pages cli. and clii.).

SUBSCRIPTIONS.—1. *Annual.*—The subscription of a Governor is £5, and that of a Member £1, due in advance on the 1st of January of each year, and becoming in arrear if unpaid by the 1st of June.

2. *For Life.*—Governors may compound for their subscriptions for future years by paying at once the sum of £50, and Members by paying £10. Governors and Members who have paid their annual subscription for 20 years or upwards, and whose payments are not in arrear, may compound for future annual subscriptions, that of the current year inclusive, by a single payment of £25 for a Governor, and £5 for a Member. No Governor or Member can be allowed to enter into composition for life until all subscriptions due by him at the time shall have been paid.

No Governor or Member in arrear of his subscription is entitled to any of the privileges of the Society.

PAYMENTS.—Subscriptions may be paid to the Secretary, in the most direct and satisfactory manner, either at the office of the Society, No. 12, Hanover Square, London, W., or by means of crossed cheques in favour of the Secretary, or by postal orders, to be obtained at any of the principal post-offices throughout the kingdom, and made payable at the Vere Street Office, London, W. In obtaining postal orders care should be taken to give the postmaster the correct name of the Secretary of the Society (Ernest Clarke), otherwise the payment may be refused to him at the post-office on which such order has been obtained; and when making remittances it should be stated by whom, and on whose account, they are sent. Cheques should be crossed "London and Westminster Bank."

On application to the Secretary, forms may be obtained for authorising the regular payment, by the bankers of individual members, of each annual subscription as it falls due. Members are particularly invited to avail themselves of these Bankers' orders, in order to save trouble both to themselves and to the Society. When payment is made to the London and Westminster Bank, St. James's Square Branch, as the bankers of the Society, it will be desirable that the Secretary should be advised by letter of such payment, in order that the entry in the bankers' book may be at once identified, and the amount posted to the credit of the proper person. No coin can be remitted by post, unless the letter be registered.

NEW MEMBERS.—Every candidate for admission into the Society must be proposed by a Member; the proposer to specify in writing the full name, usual place of residence, and post-town, of the candidate, either at a Council meeting, or by letter addressed to the Secretary. Forms of Proposal may be obtained on application to the Secretary. The Secretary will inform new Members of their election by letter.

*** Members may obtain on application to the Secretary copies of an abstract of the Charter and Bye-laws, of a Statement of the General Objects, &c., of the Society, of Chemical, Botanical, and Veterinary Privileges, and of other printed papers connected with special departments of the Society's business.

Governors' and Members' Privileges of Chemical Analysis.

(Applicable only to the case of Persons who are not commercially engaged in the manufacture or sale of any substance sent for Analysis.)

THE Council have fixed the following rates of Charges for Analysis to be made by the Consulting Chemist for the *bonâ-fide* and sole use of Members of the Society. Members have also the privilege of sending samples for Analysis on behalf of any farming company of which they may be directors or managers, provided that the substances so sent shall be for use on the farm of the Company and not for sale to other persons. Members of the Society are also allowed to send to the Society's Laboratory for analysis, at the same scale of fees, any manures and feeding stuffs which are to be used by their outgoing tenants, or which they propose to **give free of cost to their occupying tenants.**

These analyses are given on the understanding that they are required for the individual and sole benefit of the Member applying for them, and must not be used for other persons, or for commercial purposes. Except in case of dispute, the analyses and reports must not be communicated to either vendor or manufacturer. Land or Estate Agents and others sending samples for analysis on behalf of their principals are only entitled to do so when the latter are themselves Members. The names of the principals should in such cases be given.

To avoid all unnecessary correspondence, Members are particularly requested, when applying to the Consulting Chemist, to mention the kind of analysis they require, and to quote its **number in the subjoined schedule.**

The charge for analysis, together with the cost of the carriage of the specimens (if any), **must be paid to the Consulting Chemist at the time of application.**

No.		
1.—An opinion of the genuineness of bone-dust or oil-cake (each sample)	. . .	2*s.* 6*d.*
2.—An estimate of the value (relatively to the average samples in the market) of sulphate and muriate of ammonia and of the nitrates of potash and soda	. . .	5*s.*
3.—An analysis of guano: showing the proportion of moisture, organic matter, sand, phosphate of lime, alkaline salts and ammonia, and an estimate of its value, **provided the selling price of the articles to be analysed be sent with it**	. . .	**10*s.***
4.—An analysis of mineral superphosphate of lime for soluble phosphates only, and an estimate of its value, provided the selling price of the article to be analysed be **sent with it**	. . .	**5*s.***
5.—An analysis of superphosphate of lime, showing the proportions of moisture, organic matter, sand, soluble and insoluble phosphates, sulphate of lime, and ammonia, and an estimate of its value, provided the selling price of the article to be analysed **be sent with it**	. . .	**10*s.***
6.—An analysis, showing the value of bone-dust or any other ordinary artificial manure, provided the selling price of the manure to be analysed be sent with it.		10*s.*
7.—An analysis of limestone, showing the proportion of lime	. . .	**7*s.* 6*d.***
8.—An analysis of limestone, showing the proportion of lime and magnesia	. . .	10*s.*
9.—An analysis of limestone or marls, showing the proportion of carbonate, phosphate, and sulphate of lime and magnesia, with sand and clay	. . .	10*s.*
10.—Partial analysis of a soil, including determinations of clay, sand, organic matter, **and carbonate of lime**	. . .	**10*s.***
11.—Complete analysis of a soil	. . .	**£3**
12.—An analysis of oil-cake or other substance used for feeding purposes, showing the proportion of moisture, oil, mineral matter, albuminous matter, and woody fibre, as well as of starch, gum, and sugar in the aggregate; and an opinion of its feeding and fattening or milk-producing properties	. . .	10*s.*
13.—Analysis of any vegetable product	. . .	10*s.*
14.—Analysis of animal products, refuse substances used for manures, &c.	.	from 10*s.* to £1
15.—Determination of the "hardness" of a sample of water before and after boiling	.	5*s.*
16.—Analysis of water of land-drainage, and of water used for irrigation	. . .	£1
17.—Analysis of water used for domestic purposes	. . .	£1 10*s.*
18.—Determination of nitric acid in a sample of water	. . .	10*s.*
19.—An analysis of a sample of milk (to assist Members in the management of their Dairies and Herds, *bonâ fide* for their own information and not for trade purposes, or for use in connection with the Sale of Food and Drugs Acts)	. . .	5*s.*
20.—Examination of viscera for metallic poison	. . .	**£2 2*s.***
21.—Examination of viscera complete, for metals and alkaloids	. . .	£5 5*s.*
22.—Personal consultation with the Consulting Chemist. (The usual hours of attendance, Monday excepted, will be from 11 to 3, but to prevent disappointment it is suggested that Members desiring to hold a consultation with the Consulting **Chemist should write to make an appointment)**	. . .	5*s.*
23.—Consultation by letter	. . .	5*s.*
24.—Consultation necessitating the writing of three or more letters	. . .	10*s.*

The Laboratory of the Society is at 12, Hanover Square, London, W., to which address the Consulting Chemist, Dr. J. Augustus Voelcker, requests that all letters and parcels (carriage and postage paid) from Members of the Society who are entitled to avail themselves of the foregoing Privileges should be directed. Cheques and Postal Orders should be crossed "London **and Westminster Bank."**

GUIDE TO THE PURCHASE OF ARTIFICIAL MANURES AND FEEDING STUFFS.

FEEDING CAKES.

1. *Linseed-cake* should be purchased as "Pure," and the insertion of this word on the invoice should be insisted upon. The use of such words as "Best," "Genuine," &c., should be objected to by the purchaser.

2. *Rape-cake for feeding purposes* should be guaranteed "Pure," and purchased by sample.

3. *Decorticated Cotton-cake* should be guaranteed "Pure," and purchased by sample.

4. *Undecorticated Cotton-cake* should be guaranteed "Pure," and purchased by sample.

N.B.—All feeding cakes should be purchased in good condition, and the guarantee of the vendor should be immediately checked by a fair sample (taken out of the middle of the cake) being at once sent for examination to a competent analytical chemist. The remainder of the cake from which the sample sent for examination had been taken should be sealed up in the presence of a witness, and retained by the purchaser for reference in case of dispute.

ARTIFICIAL MANURES.

1. *Raw or Green Bones or Bone-dust* should be purchased as "Pure" Raw Bones guaranteed to contain from 45 to 48 per cent. of tribasic phosphate of lime, and to yield not less than 4 per cent. of ammonia.

2. *Boiled Bones* should be purchased as "Pure" Boiled Bones guaranteed to contain from 55 to 60 per cent. of tribasic phosphate of lime, and to yield not less than 1 per cent. of ammonia.

3. *Dissolved Bones* are made of various qualities, and are sold at various prices per ton; therefore the quality should be guaranteed under the heads of *soluble* phosphate of lime, *insoluble* phosphate of lime, and nitrogen or its equivalent as ammonia. The purchaser should also stipulate for an allowance for each unit per cent. which the dissolved bones should be found on analysis to contain less than the guaranteed percentages of the three substances already mentioned.

4. *Mineral Superphosphates* should be guaranteed to be delivered in a sufficiently dry and powdery condition, and to contain a certain percentage of *soluble* phosphate of lime, at a certain price per unit per cent., no value to be attached to *insoluble* phosphates.

5. *Compound Artificial Manures* should be purchased in the same manner and with the same guarantees as Dissolved Bones.

6. *Nitrate of Soda* should be guaranteed by the vendor to contain 95 per cent. of pure nitrate.

7. *Sulphate of Ammonia* should be guaranteed by the vendor to contain not less than 24 per cent. of ammonia.

8. *Peruvian Guano* should be sold under that name, and guaranteed to be in a dry and friable condition, and to contain a certain percentage of ammonia.

N.B.—Artificial manures should be guaranteed to be delivered in a sufficiently dry and powdery condition to admit of distribution by the drill. A sample for analysis should be taken, not later than three days after delivery, by emptying several bags, mixing the contents together, and filling two tins holding about half a pound each, in the presence of a witness. Both the tins should be sealed, one kept by the purchaser for reference in case of dispute, and the other forwarded to a competent analytical chemist for examination.

INSTRUCTIONS FOR SELECTING AND SENDING SAMPLES FOR ANALYSIS.

ARTIFICIAL MANURES.—Take a large handful of the manure from three or four bags, mix the whole on a large sheet of paper, breaking down with the hand any lumps present, and fold up in tinfoil, or in oil-silk, about 3 oz. of the well-mixed sample, and send it to 12 HANOVER SQUARE, W., by post; or place the mixed manure in a small wooden or tin box, which may be tied by string, but must not be sealed, and send it by post. If the manure be very wet and lumpy, a large boxful, weighing from 10 to 12 oz., should be sent either by post or railway.

Samples not exceeding 4 oz. in weight may be sent by post, by attaching two penny postage stamps to the parcel.

Samples not exceeding 8 oz., for three penny postage stamps.

Samples between 8 and 12 oz. can be sent by parcel post for threepence.

The parcels should be addressed: DR. J. AUGUSTUS VOELCKER, 12 HANOVER SQUARE, LONDON, W., and the address of the sender or the number of mark of the article be stated on parcels.

The samples may be sent in covers, or in boxes, bags of linen or other materials.

SOILS.—Have a wooden box made 6 inches long and wide, and from 9 to 12 inches deep, according to the depth of soil and subsoil of the field. Mark out in the field a space of about 12 inches square; dig round in a slanting direction a trench, so as to leave undisturbed a block of soil with its subsoil 9 to 12 inches deep; trim this block or plan of the field to make it fit into the wooden box, invert the open box over it, press down firmly, then pass a spade under the box and lift it up, gently turn over the box, nail on the lid, and send it by goods or parcel train to the laboratory. The soil will then be received in the exact position in which it is found in the field.

In the case of very light, sandy, and porous soils, the wooden box may be at once inverted over the soil and forced down by pressure, and then dug out.

WATERS.—The water, if possible, should be sent in a glass-stoppered Winchester half-gallon bottle, which is readily obtained in any chemist and druggist's shop. If Winchester bottles cannot be procured, the water may be sent in perfectly clean new stoneware spirit-jars, surrounded by wickerwork. For the determination of the degree of hardness before and after boiling, only one quart wine-bottle full of water is required.

LIMESTONES, MARLS, IRONSTONES, AND OTHER MINERALS.—Whole pieces, weighing from 3 to 4 oz., should be sent enclosed in small linen bags, or wrapped in paper. Postage 2*d*., if under 4 oz.

OILCAKES.—Take a sample from the middle of the cake. To this end break a whole cake into two. Then break off a piece from the end where the two halves were joined together, and wrap it in paper, and send by parcel post. The piece should weigh at least from 10 to 12 oz. If sent by railway, one quarter or half a cake should be forwarded, carriage prepaid.

FEEDING MEALS.—About 3 oz. will be sufficient for analysis. Enclose the meal in a small linen bag. Send it by post.

On forwarding samples, separate letters should be sent to the Laboratory specifying the nature of the information required, and, if possible, the object in view.

Members' Veterinary Privileges.

I.—Visits of a Professor of the Royal Veterinary College.

1. Any Member of the Society who may desire professional attendance and special advice in cases of disease among his cattle, sheep, or pigs, should apply to the Secretary of the Society, or to the Principal of the Royal Veterinary College, Camden Town, London, N.W.

2. The remuneration of the Veterinary Surgeon or a Visiting Inspector will be 2*l.* 2*s.* each day as a professional fee, and the charge for personal expenses, *when such have been incurred*, which will in no case exceed one guinea per diem. He will also be allowed to charge the cost of travelling, including railway fare, and one shilling per mile if by road, to and from the locality where his services may have been required. The whole or any portion of these charges may, however, in case of serious or extensive outbreaks of contagious disease, be remitted, so far as the Members of the Society are concerned, at the discretion of the Council, on such step being recommended to them by the Veterinary Committee.

3. The Consulting Veterinary Surgeon or Visiting Inspector, on his return, will report to the Member, and, through the Principal of the Royal Veterinary College, to the Veterinary Committee, in writing, the result of his observations and proceedings with reference to the disease; which Report will be laid before the Council.

4. When contingencies arise to prevent a personal discharge of the duties, the Principal of the Royal Veterinary College may, subject to the approval of the Veterinary Committee, name some competent professional person to act in his stead, who shall be remunerated at the same rate.

II.—Consultations without Visit.

Personal consultation with Veterinary Inspector . . .	10*s.* 6*d.*
Consultation by letter	10*s.* 6*d.*
Post-mortem examination, and report thereon . . .	21*s.* 0*d.*

A return of the number of applications from Members of the Society during each half-year is required from the Consulting Veterinary Surgeon.

III.—Admission of Diseased Animals to the Royal Veterinary College, Camden Town, N.W.; Investigations and Reports.

1. All Members of the Society have the privilege of sending cattle, sheep, and pigs to the Infirmary of the Royal Veterinary College, on the following terms, viz. by paying for the keep and treatment of cattle 10*s.* 6*d.* per week each animal, and for sheep and pigs, 3*s.* 6*d.* per week.

2. A detailed Report of the cases of cattle, sheep, and pigs treated in the Infirmary of the College, or on Farms in the occupation of Members of the Society, will be furnished to the Council quarterly; and also special reports from time to time on any matter of unusual interest which may come under the notice of the Officers of the College.

3. An annual grant of 200*l.* is made by the Society to the Royal Veterinary College in aid of the further development of Cattle Pathology. In order to assist the authorities of the College in making the necessary investigations, Members of the Society are particularly requested to send to the College any diseased animals (cattle, sheep, or swine) which they would otherwise destroy as useless, and also any specimens of diseased parts of an unusual character. In the event of living animals being sent, it will be necessary to telegraph to the College at Camden Town the time of their arrival at a London station, so that a van may be sent to meet them. The expense of transit will be defrayed by the Royal Veterinary College.

IV.—Visits of Provincial Veterinary Surgeons.

The following Veterinary Surgeons have been appointed, at different centres in England and Wales, for the purpose of enabling Members of the Society to consult them with regard to the diseases of cattle, sheep, and pigs.

County.	*Name and Address.*
Anglesey	Hugh Jones, Brynarron, Langefni.
Bedford	Henry Crofts, Harper Street, Bedford.
Berks	Henry Allnutt, Thames Street, Windsor.
Brecon	John Price, Brecon.

County.	*Name and Address.*
Bucks	G. A. Lepper, Aylesbury.
Cambridge	G. A. Banham, Downing Street, Cambridge.
Cardigan	Not yet appointed.
Carmarthen	Ditto.
Carnarvon	R. Roberts, Market Street, Abergele.
Chester	W. Lewis, 1 South Street, Nantwich Road, Crewe.
Cornwall	Thos. Olver, Truro.
Cumberland	John Bell, Lonsdale Street, Carlisle.
Denbigh	R. Roberts, Market Street, Abergele.
Derby	Not yet appointed.
Devon	W. Penhale, Barnstaple.
Dorset	W. Vessey, Weymouth.
Durham	John E. Peele, 8 New Elvet, Durham.
Essex	James Taylor, Vengewell Hall, Wix, Manningtree.
Flint	R. Roberts, Market Street, Abergele.
Glamorgan	Charles Moir, Cardiff.
Gloucester	Professor Nicholson Almond, Royal Agricultural College, Cirencester.
Hants	J. D. Barford, 57 Above Bar, Southampton.
Hereford	W. Good, 30 Mill Street, Ludlow.
Herts	W. Wilson, Berkhampstead.
Hunts	A. T. Sprague, Kimbolton.
Kent	W. A. Edgar, Westfield House, Dartford.
Lancaster	J. B. Polding, Red Lion Street, Burnley.
Leicester	John Wiggins, Market Harbro'.
Lincoln (South)	Captain B. H. Russell, Grantham.
Lincoln (Mid)	Charles Hartley, 4 Norman Place, Lincoln.
Lincoln (North)	J. B. Greswell, Mercer Row, Louth.
Merioneth	Evan Wynne Williams, 1 Queen's Row, Dolgelly.
Metropolis and Middlesex	Royal Veterinary College, Camden Town.
Monmouth	G. Lewis, Monmouth.
Montgomery	James M'Cavin, Montgomery.
Norfolk	Frederick Low, Norwich.
Northampton	T. J. Merrick, Castilian Street, Northampton.
Northumberland and Westmorland	C. Stephenson, Sandyford Villa, Newcastle-on-Tyne.
Notts	Mr. Frank H. Gibbings, Albert Square, Derby Road, Nottingham.
Oxford (North)	Chas. N. Page, Banbury.
Oxford (South)	J. P. S. Walker, Oxford.
Pembroke	Not yet appointed.
Salop	W. E. Litt, Shrewsbury.
Somerset	T. D. Broad, Broad Street, Bath.
Stafford	Harry Olver, Trescoe, Tamworth.
Suffolk	J. Worsley, Ipswich.
Surrey	J. L. Lupton, Richmond.
Sussex (East)	R. A. Stock, Lewes.
Sussex (West)	I. H. Callow, Horsham.
Warwick	Osborn Hills, Leamington.
Wilts	H. Hussey, Devizes.
Worcester	H. R. Perrins, Upper Butts, Worcester.
York (East Riding)	James Jebson, Yapham Grange, Pocklington.
York (North Riding)	W. Barker, Middlesborough.
York (West Riding)	Joseph Carter, 28 Great Horton Road, Bradford.

Members may obtain the attendance of a Provincial Veterinary Surgeon in any case of disease by paying his travelling expenses (which include railway fares, and 1*s.* per mile if by road, including the return journey), and the cost of his visit, which will be at the following rate, viz. :—

	£	*s.*	*d.*
When the whole day is occupied	1	10	0
When half a day or less is occupied	0	15	0
Personal consultation with Veterinary Surgeon	0	10	0
Consultation by letter	0	5	0
Post-mortem examination and report thereon	1	0	0

A return of the number of applications from Members of the Society during each half-year, embodying a statement of those cases which may be of public interest, is required from each Provincial Veterinary Surgeon. These half-yearly reports should reach the Secretary by the end of May and November respectively.

Members' Botanical Privileges.

The Council have fixed the following rates of charge for the examination, by the Society's Consulting Botanist, of Plants and Seeds, for the *bonâ fide* and individual information and benefit of Members of the Society (not being seedsmen).

The charge for examination must be paid at the time of application, and the carriage of all parcels must be prepaid.

No.		
1.—	A report on the purity, amount, and nature of foreign materials, the perfectness and germinating power of a sample of seed .	1*s*.
2.—	Determination of the species of any weed or other plant, or of any epiphyte or vegetable parasite, with a report on its habits, and the means for its extermination or prevention	1*s*.
3.—	Report on any disease affecting farm crops	1*s*.
4.—	Determination of the species of a collection of natural grasses found in any district, with a report on their habits and pasture value .	5*s*.

N.B.—The Consulting Botanist's Reports on Seeds are furnished to enable Members,—purchasers of seeds and corn for agricultural or horticultural purposes,—to test the value of what they buy, and are not to be used or made available for advertising or trade purposes.

PURCHASE OF SEEDS.

The purchaser should obtain from the vendor, by invoice or otherwise, a proper designation of the seed he buys, with a guarantee that it contains not more than a specified amount of other seeds, and is free from ergot, or, in the case of clovers, from dodder, and of the percentage of seeds that will germinate.

The germination of cereals, green crops, clovers, and timothy grass should be not less than 90 per cent.; of foxtail, not less than 60 per cent.; of other grasses, not less than 70 per cent.

The Council strongly recommend that the purchase of prepared mixtures should be avoided, and that the different seeds to be sown should be purchased separately.

INSTRUCTIONS FOR SELECTING AND SENDING SAMPLES.

I. Seeds.

In sending seed or corn for examination the utmost care must be taken to secure a fair and honest sample. In the case of grass-seeds, the sample should be drawn from the centre of the sack or bag, and in all cases from the bulk delivered to the purchaser and not from the purchased sample. When bought by sample the whole or part of that sample should be sent.

When it is considered necessary to secure legal evidence, the sample should be taken from the bulk and placed in a sealed bag in the presence of a reliable witness who is acquainted with the identity of the bulk, and care should be taken that the purchased sample and bulk be not tampered with after delivery, or mixed or come in contact with any other sample or stock.

One ounce of grass and other small seeds should be sent, and two ounces of cereals or larger seeds. The exact name under which each sample has been bought should be sent with it.

Grass-seeds should be sent at least FOUR WEEKS, *and clover-seeds* TWO WEEKS *before they are required, and they should not be sown until the report has been received.*

II. Plants.

In collecting specimens of plants, the whole plant should be taken up, and the earth shaken from the roots. If possible, the plants must be in flower or fruit. They should be packed in a light box, or in a firm paper parcel.

Specimens of diseased plants or of parasites should be forwarded as fresh as possible. They should be placed in a bottle, or packed in tinfoil or oil-silk.

All specimens should be accompanied with a letter specifying the nature of the information required, and stating any local circumstances (soil, situation, &c.) which, in the opinion of the sender, would be likely to throw light on the inquiry.

Parcels or letters containing seeds or plants for examination (carriage or postage prepaid) must be addressed to Mr. W. Carruthers, F.R.S. 44 Central Hill, Norwood, London, S.E.

Members' Entomological Privileges.

The Council have fixed the charge of 2*s.* 6*d.* for the determination of the species of any insect, worm, or other animal which, in any stage of its life, injuriously affects farm-crops, with a report on its habits, and suggestions as to the methods of prevention and remedy.

Portions of the plants injured should accompany the specimens of the insects.

All specimens should be sent in tin or wooden boxes, or in quills, so as to prevent injury in transmission.

Parcels or letters containing specimens (carriage or postage paid) must be addressed to Miss E. A. Ormerod, F.R.Met.Soc., Torrington House, Holywell Hill, St. Albans.

General Privileges of Members.

Free admission to the Show-Yard and to the Grand Stands at the Country Meetings, during the time the Show is open to the public, by tickets issued by the Secretary; Exhibition of Live Stock and Implements at the Country Meetings at a reduced charge; the Journals of the Society which belong to the year for which their subscription has been paid transmitted by post, free of charge, to their address; analyses of Manures, Feeding Stuffs, &c., made at a reduced charge by the Consulting Chemist (pp. cxlvi to cxlviii), and examination of Plants and Seeds by the Consulting Botanist (p. cli), and of Insects, &c., by the Consulting Entomologist (p. clii); the liberty of consulting the books in the Library and to use the Reading Room; leave to report the outbreak of disease among cattle, sheep, and pigs, and to request the personal attendance of one of the Society's Veterinary Inspectors; power of sending cattle, sheep, and pigs to the Royal Veterinary College on payment of a small sum for keep and treatment (pp. cxlix and cl).

No member in arrear of his subscription is entitled to any of the privileges of the Society.

All Members belonging to the Society are bound to pay their annual subscriptions, until they shall withdraw from it by notice in writing to the Secretary.

Journal.—The Parts of the Society's Journal are published half-yearly, and (when the subscription is not in arrear) they are forwarded by post or carrier to Members, or delivered from the Society's office to Members or to the bearer of their written order.

The back numbers of the Journal are kept constantly on sale by the publisher, John Murray, 50a Albemarle Street, W.

*** All communications intended for the Society should be addressed to the Secretary, at the House of the Society, 12 Hanover Square, London, W. Replies by Telegraph cannot be sent unless paid for in advance, and cannot be guaranteed in any case.